# Creativity and Learning in Digital Entertainment Games

## Thesis


# Creativity and Learning in Digital Entertainment Games

**Johanna Hall**

Thesis submitted to The Open University for the degree of Doctor of Philosophy

Institute of Educational Technology (IET)

The Leverhulme Trust

June 2020

Johanna Hall The Open University

# Abstract

Creativity has been investigated in areas such as education, the workplace and psychology. However, there remains little in the way of a unanimous definition of what it means to be creative – with various conceptualisations illuminating different aspects of this multifaceted phenomenon. However, it is for the most part agreed that creativity contributes to a wealth of positive outcomes such as openness to experience, cognitive flexibility and emotional wellbeing. Furthermore, creativity is instrumental in facilitating a meaningful learning experience as learners can actively formulate and experiment with ideas in an authentic context. In this way, the creative process leads to ultimately the creative expression itself and subsequent positive effects such as learning.

With such a wealth of positive effects, it is surprising that creativity has not been more extensively investigated within the area of digital entertainment games. Digital games provide an authentic and active context which fosters intrinsic motivation and offer numerous opportunities for players to be creative. As such, this thesis attempts to address this gap by presenting an account of current literature on creativity in digital games, and the results from three empirical studies. The first study comprised of 24 semi-structured interviews and 14 narrative surveys and identified three unique forms of creative expression, along with three different player constructed conceptualisations of what it means to be creative in games. Further circumorbital constructs related to creativity were also identified, including creative transfer, affordances for creativity and learning outcomes from being creative. The second study consisted of an online survey completed by 251 respondents and resulted in the development of the Creativity in Gaming Scale (CGS), in addition to providing a quantitative examination of what players learn from engaging in the different forms of creative expression, and what aspects of creativity are most likely to transfer. The third study focused on affordances for creativity in digital games and utilised the reflexive photographic method alongside photo-elicitation interviews with 9 participants to identify eight types of affordances to support the different types of creative expression.

This research provides an extensive account of creativity in digital entertainment games; presenting the construct from the standpoint of the player. As such, the findings not only contribute towards presenting a holistic definition of creativity, but also highlight that creativity is an important aspect of player experience. The role of creativity in the learning process is extrapolated, with findings drawing a link between different forms of creative expression and what players may learn from being creative. Similarly, the transferable nature of creativity is investigated, with findings pointing to the different aspects of creativity which may transfer, and what areas of life they may transfer to. Finally, by identifying the specific affordances for creativity

in games, the final contribution of this research is towards informing the design of games which may actively promote creativity in players.

# Acknowledgements

This thesis would not have been able to be completed without the support of a number of people.

Most notably, I would like to thank my supervisors: Ursula Stickler, Christothea Herodotou and Jo Iacovides. Their constant support and encouragement were instrumental in all stages of this project, and their knowledge a valuable source of learning.

The participants themselves who gave their time and shared their experiences deserve special thanks. It was uplifting to talk to so many people who felt passionately about games and believed in their importance in providing opportunities for creativity.

I would like to thank the PhD students of IET who have helped in various ways throughout the course of this project; providing assistance with advertising studies, recommending resources and giving words of encouragement.

Finally, I would like to thank my mother, Kathryn Hall, and partner, Gordon Donald for their love and support in helping me undertake this project.

[This page is intentionally left blank]

# Declaration of Authorship

I declare that this thesis has been composed solely by myself and that it has not been submitted, either in whole or in part, in any previous application for a degree. Except where otherwise acknowledged, the work presented is entirely my own.

References to relevant work:

Hall, J., Stickler, U., Herodotou, C. and Iacovides, I. (2020). Expressivity of Creativity and Creative Design Considerations in Digital Games. *Computers in Human Behavior*, 105 (106206).

Hall, J., Stickler, U., Herodotou, C. and Iacovides, I. (2019). Player conceptualizations of creativity in digital entertainment games. *Convergence: The International Journal of Research into New Media Technologie*s (Early Access).

[This page is intentionally left blank]

# Table of Contents

# List of Figures

# List of Tables

# List of Abbreviations

MMO – Massively Multiplayer Online

MMORPG – Massively Multiplayer Online Role-Playing Game

FPS – First Person Shooter

UCC – User Created Content

MDA – Mechanics, Dynamics and Aesthetics Framework

CGS – Creativity in Gaming Scale

HCI – Human-Computer Interaction

[This page is intentionally left blank]

# 1. Introduction

## 1.1 Rationale

This thesis seeks to explicate how players may experience and express creativity within different types of digital entertainment games, what they may learn from engaging in such creative practices, and what aspects of game design afford creative opportunities to players.

Creativity is a multifaceted construct, with an exact definition hard to pinpoint. However, it has been, for the most part, agreed to contribute to positive benefits such as increased wellbeing (Plucker et al., 2004), meaningful learning (Ferguson, 2011) and positive psychological health and openness (Richards, 2007, 2010). Creativity has been studied as a process (e.g. Amabile, 1982; Baer & McKool, 2009), an outcome (e.g. Csikszentmilhalyi, 1996) and a personality trait (e.g. Amabile, 1990). The realisation of creativity depends as much on the person and their history as it does on the context in which it takes place – with what is creative for one individual, not necessarily being creative for another. Creativity, in terms of a process, has also been argued to be a facilitator for successful learning (Mishra et al., 2013). Where the demarcation begins and ends between what is deemed a creative process and a creative outcome may be blurry, and as such, in the context of this thesis, creativity is examined in a holistic sense – both as a contributor to subsequent learning outcomes, and as an outcome in itself in the form of different creative expressions.

While creativity has been investigated in other domains of life such as music, work and education, there is scant literature which investigates the role of player creativity in digital entertainment games. According to Malone (1981), digital games encompass challenge, curiosity and fantasy – all of which contribute to player appeal and may act as the building blocks for creative behaviour (Blascovich & Bailenson, 2011; Ferguson & Olson, 2013). Ill-structured challenges are inherent in many games, offering players a multitude of ways to solve particular problems and encouraging exploration, discovery and reflection (Kiili, 2005). Moreover, risk-taking has been argued to be a core component of the creative process– something which games promote through allowing players to experiment in a context that produces lower levels of the same types of physical and emotional responses than real-life situations (Fischer et al., 2009; Gee, 2005; Järvinen, 2008). Although there are many theories which seek to define creativity, most work concerning the benefits of digital games has granted limited focus on player creativity, with research focusing usually on only one aspect of this highly complex phenomenon. As such, there currently does not exist an extensive account of the different expressions of player creativity in digital games, and similarly, how players themselves define what it means to be creative in games. By explicating the role of creativity in the player experience, further related avenues of

consideration such as the role of creativity in learning, personal development and enjoyment may be illuminated.

Creativity has been suggested to contribute to, among other things, lifelong learning, cognitive flexibility and openness to experience (Amabile, 1983; McCrae, 1987; Ott & Pozzi, 2012). Plucker et al. (2004) argue that creativity is important not only for educational and personal success but also for the development of cognitive abilities such as problem solving, as well as social and emotional wellbeing. Furthermore, within the business sector, creativity has been identified as the foundation of economic and technical development, with corporations investing in creativity education (Hennessey & Amabile, 1998; Plucker et al., 2004; Stevens et al., 1999). As such, creativity has been argued to be a key component to successful learning (Mishra et al., 2013). Such learning involves the construction and accommodation of knowledge and development of skills and abilities through active and authentic engagement in the creative process – in this way assumptions are dismantled, and hypotheses tested allowing new knowledge and understanding to be constructed. In terms of digital games, previous work has broached that players can informally learn a variety of different skills such as language skills (e.g. Bytheway, 2015), problem-solving (Iacovides et al., 2014a) critical thinking (e.g. Sourmelis et al., 2017), social (e.g. Voulgari et al., 2014) and psycho-motor skills (e.g. Iacovides et al., 2014a). Areas of learning such as cognitive and social skills have gained attention in relation to digital entertainment games, however, the creative practices of players still remain largely understudied in relation to learning (Qian & Clark, 2016; Sourmelis et al., 2017). As Iacovides et al. (2011) point out, a better understanding of what occurs during everyday game-play practices is needed to illuminate exactly what players may learn when playing commercial entertainment games and, as such, by studying the creative practices of players we may shed light on what specific learning outcomes can be gained from being creative, and subsequently illuminate the role of creativity in the learning process.

In addition to contributing to a wealth of positive effects and as a key component in the learning process, the transferrable nature of creativity has been cited as being important in the new digital economy. It has been argued that we now live in a "creative society" where the ability to think and act creatively is instrumental to success in both work and life (Resnick, 2007). As such, initiatives such the Partnership for 21st Century Skills (2019) have incorporated creativity into their framework alongside other domain unspecific competencies including collaboration, critical thinking, problem-solving and planning. However, questions remain in relation to what aspects of game-based creativity may transfer, and what other areas of life such aspects may transfer to.

In short, games incorporate many characteristics which would suggest they are an apt

medium for creativity to take place. However, there remains a grey area as to what exactly constitutes player creativity, and how players themselves define what it means to be creative. Furthermore, creativity has yet to be fully considered in relation to the informal learning which occurs in entertainment games, and in relation to what role creativity may play in the development of learning outcomes. The transferrable nature of creativity has attracted focus from educationalists in terms of frameworks such as the 21st Century Skills. However, we still know little about what specific aspects of creativity may transfer, and where. Finally, creativity has yet to be fully considered in relation to the design of games, with gaps in the literature around what aspects of game design may act as affordances for player creativity.

## 1.2 Contributions

This thesis aims to provide a holistic account of player creativity in digital games. The contributions of this thesis are fivefold: firstly, by presenting a unified definition of creativity and examining the different ways in which creativity is expressed by players of digital entertainment games, this thesis illuminates a valuable yet underexplored aspect of the player experience. Through understanding how different types of games contribute to the different forms of creativity we can further understand how games can be used to promote creative behaviour, not just from an entertainment perspective but also in other domains such as education.

Second, whilst there exists a multitude of conceptualisations of creativity, little is known about how players themselves define and view creativity in the context of gaming. By unpacking player perspectives on creativity, a conceptualisation of creativity that relates to digital games can be posited in the hope of guiding further work which seeks to define the role of creativity in the player experience.

Third, the role of creativity in the learning process has been granted little focus, and this thesis aims to provide the initial groundwork for future studies which examine the relationship between creativity and learning. Creativity involves a variety of different skills and by drawing a link between the different forms of creative expression in games and what players may learn from these instances, we can gain a better understanding of what areas of learning creativity may contribute to.

Fourth, creativity appears to involve highly transferrable skills such as problem-solving and personality traits such as cognitive flexibility and openness to experience. By examining what aspects of creativity may transfer, a greater understanding of the transferable nature of creativity will be gained in terms of what aspects of creativity are most likely to transfer and where.

Fifth, this thesis aims to contribute to establishing what specific elements of game design may contribute to player creativity. By illuminating this understudied area, the final contribution

of this thesis is to the field of game design. If we can understand what mechanisms support or inhibit creativity in digital games, then games can be actively designed with creativity in mind.

## 1.3 Thesis Structure

This chapter is a general guide for the reader, outlining the rationale for the thesis and its primary contributions. This section provides a short overview of what can be expected in each of the chapters.

**Chapter 2 - Literature Review**

Chapter 2 will begin by situating the constructs within the epistemological position of constructivism before reviewing literature in relation to the three main constructs under investigation: creativity, learning and affordances. For all sections, the constructs will be contextualised within the area of digital entertainment games. A final section (2.5) will offer up conclusions from the literature reviewed in conjunction with highlighting the gaps in the field and presenting the research questions.

**Chapter 3 - Methodology**

Chapter 3 will cover the pragmatist research paradigm adopted and methodology used, justifying the choice of methodology in the light of previous work which has used similar methodologies. A rationale will be given for why the particular methods and materials were chosen. The section will finish with an overview of ethical considerations for the research conducted.

**Chapter 4 - Phase 1: Expressivity of Creativity and Player Conceptualisations of Creativity in Digital Games**

Chapter 4 will cover phase 1 which aimed to explore how players define what it means to be creative in games, and what the different expressions of creativity within gaming may look like from a player's perspective. The research questions addressed in this phase were:

- *RQ 1a: How is creativity expressed within digital entertainment games?*
- *RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?*

Phase 1 consisted of exploratory semi-structured interviews with 24 participants and a narrative survey completed by a further 14 participants. Section 4.1 will begin with a discussion of

the participants, recruitment methods, data collection and data analysis. Section 4.2 will cover the findings on expressivity of creativity, player conceptualisations of creativity as well as initial findings relating to learning, transferability and design affordances. Each finding section will be accompanied by a discussion of the theme in relation to the relevant literature. Section 4.3 provides a conclusion and section 4.4 outlines the limitations of the study and suggests courses of action for future work. Finally, section 4.5 describes the implications of the study and its relevance for further phases.

**Chapter 5 – Phase 2: Learning and Transferability in Digital Games**

Chapter 5 will cover phase 2 which aimed to uncover what specific learning outcomes players gained from engaging in game-based creativity practices, and what aspects of creativity were transferrable between games and other domains of life. The research questions addressed were:

- *RQ 2a: What do players learn from engaging in game-based creative practices?*
- *RQ 2b: What aspects of game-based creativity are transferrable between games and real-life?*

Phase 2 consisted of an online gaming and creativity survey completed by 251 respondents. Section 5.1 will follow the same format as 4.1. Section 5.2 will cover the findings, outlining both an initial factor model and a refined five factor solution. Additional analyses in relation to the five-factor model will be covered including mean analysis, reliability analysis, and multiple regression analysis. Findings will be discussed for each in turn. Section 5.3, 5.4 and 5.5 will take the same format as the conclusion, limitations and implications sections in chapter 4.

**Chapter 6 – Phase 3: Design Affordances for Creativity in Digital Games**

Chapter 6 will cover phase 3 which aimed to examine what specific design affordances in games contribute to player creativity. The research question addressed was:

- *RQ 3: What specific game design affordances contribute to player creativity?*

Phase 3 consisted of a reflexive photography task followed by photo-elicitation interviews with 9 participants. The chapter will follow the same format as chapter 4.

**Chapter 7 – Conclusions**

Chapter 7 will summarise the main conclusions to the project, outline the main contributions, highlight the limitations of the project as a whole and present suggestions for avenues of future work.

# 2. Literature Review

This chapter will cover existing literature on the three main areas of focus in this thesis. Section 2.1 will outline the epistemological standpoint taken in this thesis; namely, constructivism and its relation to both the creative process, and the outcomes of said process. Section 2.2 will consider creativity in relation to existing domain unspecific conceptualisations before examining work which has focused on elements of creativity in digital games. To conclude, the last section will provide a working definition of creativity which will be used in the context of this thesis. Section 2.3 on learning in digital games will look at existing work concerning informal learning in digital entertainment games, followed by a section on creativity as a transferrable competency. Section 2.4 on affordances will begin with locating the construct within the wider field of HCI before looking specifically at affordances for player creativity in digital games, considering various theories and views in terms of game design, motivation, game mechanics, narrative and customisation. Finally, section 2.5 will attempt to coalesce the areas of concern in the literature covered and define the corresponding research questions and contributions.

## 2.1. Constructivism

Creativity is not something which can be taught in the traditional sense (i.e. via rote learning) but is developed over time and in relation to an individual and context. Similarly, the process of being creative requires construction of knowledge and development of abilities – whether these are problem-solving skills or learning about a particular topic. The outcomes of the creative process are ultimately both the creative expression in itself and the culmination of circumorbital abilities, learning and knowledge which made the creative expression possible.

In this way, the constructivist notion aligns both with the creative process itself, in addition to the effectuation of outcomes from this process. Constructivism can be defined as "the belief that reason is the primary source of knowledge and that reality is constructed rather than discovered" (Smith & Ragan, 2005, p. 19). Unlike objectivism, which argues that social phenomena and meanings are separate to the individuals who experience them, constructivism states that "individuals create or construct their own new understandings or knowledge through the interaction of what they already believe and the ideas, events, and activities with which they come into contact" (Ültanır, 2012, p. 1). Cognitive constructivism which stems predominantly from the work of Piaget (1952, 1959, 1976), believes that knowledge is not directly transferrable from person to person and instead knowledge is individually constructed and discovered (Liu & Matthews, 2005). Piaget stated that learning should be structured around the learner, suggesting that through the processes of assimilation and accommodation, the learner is able to construct

knowledge from their experiences (Qiong, 2010). On the other hand, Vygotsky (1962) emphasized the role of outside influences such as other people and cultural artifacts which, he argued, shape the learners' emergent mental functions (Bodrova, 2003). This type of constructivism has come to be known as social constructivism, believing that learners are "encultured into their learning community and appropriate knowledge, based on their existent understanding, through their interaction with the immediate learning environment" (Liu & Matthews, 2005, p. 3).

As such, constructivism plays an important part in creativity in the context of this thesis. It serves as a foundation in relation to how players construct the definition of what it means to be creative, how their creativity is expressed and influenced by the context within which it takes place, what learning occurs informally through this creative process, and illuminates the subjective nature of affordances for creativity in game design. In this way, this thesis does not pose an objective reality of creativity (if such a thing exists), but instead presents the interpretations, ideas, and conceptualisations of creativity which are dependent on context, time, and of course, individuals themselves.

## 2.2 Creativity

The question of "what exactly is creativity?" has much of the time been ignored or entangled in a variety of answers. In reviewing ninety articles involving creativity, Plucker et al. (2004) discovered that only 38% explicitly stated what creativity was. Although many researchers are in consensus that aspects of creativity involve originality and the production of works of value to society, the definition of creativity remains ambiguous (Kerr & Gagliardi, 2003). While the outputs of creativity may lead to the view that creativity is a state, it has been argued that creativity should not be viewed in isolation to other constructs of human ability (Sternberg, 2001). Instead, creativity is considered to be a subjective experience – largely shaped by society, culture and individual personal beliefs and values (Plucker & Runco, 1998).

This section will cover some of the main approaches to creativity (section 2.2.1) before going on to examine the current literature surrounding creativity in digital entertainment games (section 2.2.2). Finally, both sections will be brought together to outline the current gaps in literature surrounding creativity in digital games and provide a definition of creativity which will be used in this thesis (section 2.2.3).

### 2.2.1 Approaches to Creativity

Creativity has been examined from a wide variety of standpoints including the cognitive sciences, biology, history, economics and developmental psychology. While far from an exhaustive list, this section will focus on the conceptualisations of creativity most pertinent to this thesis. These conceptualisations do not pertain to any particular academic field and are largely domain un-specific (i.e. they are general theories on creativity), however, examples will be given to contextualise these approaches within digital games.

#### 2.2.1.1 Big C Creativity

Big C creativity examines how creativity is culturally dependent, with creative works being judged on their appropriateness to a domain of knowledge at a particular point in time. Big C creativity can be defined as the creative outcomes of someone who is highly competent in their given domain such as Noble prize winners, great authors or famous artists who have all mastered skills in their domain (Csikszentmihalyi, 1996). In Csikszentmihalyi's Systems Model of Creativity (Csikszentmihalyi, 1999), creativity is defined as the interaction between the domain, field and the person. The domain refers to the area of expertise such as music or art, the field consists of the gatekeepers to that domain such as art critics and editors who judge the worth of creative works. The person refers to the individual who creates the idea, theory or object which the field accepts and is incorporated into the domain. At times the novelty of an idea is not recognized until years later, when the domain has sufficiently shifted to a place which recognises the appropriateness of the idea. In this way, Big C creativity is able to change and advance domains.

Big C perspectives could be used to illuminate creativity in games from the perspective of game development, most notably in terms of games which have shaped and defined particular genres such as *The Sims* (Maxis & The Sims Studio, 2000), the first example of life simulator (Franklin, 2018).

Big C perspectives have undergone numerous criticisms with the most notable being that they view creativity as a special and innate ability which only a few individuals possess. Viewing creativity in this way creates a dichotomy between what constitutes being creative and what doesn't and hence, is not inclusive of the varying categories of creative magnitude (Kozbelt et al., 2010). Additionally, in the field of education it has been argued that it is unrealistic for educational institutions to foster this type of creativity as, firstly, the majority of students may not possess Big C abilities and secondly, educational institutions are mainly concerned with facilitating the development of average students' abilities and hence usually have limited resources to support the development of exceptional individual talent (Rogaten & Moneta, 2016). This can be

further illustrated by Csikszentmihalyi's (1996) findings that the majority of creative individuals he interviewed had very little positive to say about their schooling experience, and that only in college and advanced education did their interests coincide with those of mentors and teachers. Hence, it could be concluded that Big C creativity, while only innate in a special number of individuals, is best cultivated in further educational training where there are more resources and time to spend developing exceptional ability.

#### 2.2.1.2 Little C, Mini C and Pro C

In contrast to the domain changing genius works of Big C creativity, Little C approaches such as Richards et al.'s (1988) *everyday* creativity and Maslow's (1968) *self-actualizing* creativity, argue that everyone has creative ability to some extent, and this ability can be developed further. Most research into Little C creativity is concerned with the application of everyday creativity to overcome and solve problems (Richards et al., 1988). In the context of creativity, problem solving can be defined as "any task at hand that gives opportunities for improvement and challenges for change" (Rogaten & Moneta, 2016, pp.5).

Little C creativity versus Big C conceptualisations hints at the distinction between amateur and professional creative labour. The word "amateur", while signifying negative connotations, originally derives from the Latin word of *amator* which means "lover" and refers to someone who creates solely for intrinsic enjoyment, whereas professional works of creative labour are those created with commercial value in mind and primary sold and repackaged within an industry (Lastowka, 2012). In this way, the inventions of players such as game content, modifications, and strategies could be viewed as Little C or amateur works of creativity, whilst the works of developers and game designers which are marketed and repackaged for core audiences could be viewed as professional creative labour. However, while this distinction provides a neat divide in terms of the creations of players versus developers, it does not explain the grey areas in between. For example, what about when player creations are appropriated by mainstream game developers such as in the case of the *Defense of The Ancients* (Eul et al., 2003) mod for *Warcraft III* (Blizzard Entertainment, 2002) which was picked up by the developer Valve Cooperation and made into a franchise? Or, what about the case of avante garde/indie games which are not created solely for the commercial mainstream gaming industry? The grey area between the creativity of players versus that of developers has led some scholars to define new terms such as "prosumer" (Lister et al., 2003), bringing together both consumer and producer, and "pro-am" (Leadbeater & Miller, 2004) which brings together the creative works of both professionals and amateurs.

While the Little C perspective is still a long way off from accounting for all the different

levels of creativity in games, Little C approaches are suited to pedagogical application in that they are able to illuminate the everyday application of creativity and help inform how educational practices and technologies can be structured to foster this type of creativity (Rogaten & Moneta, 2016). However, in contrast to Rogaten and Moneta's (2016) suggestion that Little C is more suited to educational practices, Kaufman and Beghetto (2009) argue that while individuals who score highly on Torrance tests (tests to measure creative cognitive abilities) may be classed as being high on Little C, it leaves out "creative insights and interpretations involved in learning" (Kaufman & Beghetto, 2009, pp.3). As such, they expanded on the 2 C model of creativity to create the 4 C model which includes *Mini C* and *Pro C*.

Mini C is defined as the "novel and personally meaningful interpretation of experiences, actions and events" (Kaufman & Beghetto, 2009, pp.3). This definition is synonymous with the Vygotskian notion of cognitive and creative development which claims that all individuals have creative potential through the "internalization or appropriation of cultural tools and social interaction" (Moran & John-Steiner, 2003, pp.63). This internalization and appropriation does not simply involve mimicking, instead the individual is able to reorganise and transform information and mental structures based on their own characteristics and pre-existing knowledge. As such it can be suggested that Mini C creativity occurs through the fluid and interpretive process of creating personal knowledge within a particular social milieu.

Pro C is located between the Little C and Big C concepts and refers to those who are professional creators who have not yet reached eminent status in their area. Pro C "represents the developmental and effortful progression beyond little c (but has not yet attained big c status)" (Kaufman & Beghetto, 2009, p. 5). Examples of Pro C could be the initial developments of a small indie game development team which break current gaming traditions, or the work of a creative individual which was renowned in their own time but has since been forgotten in their domain.

In essence, while Little C creativity can illuminate the novel ways to address everyday problems and help provide guidance on structuring learning activities, it does not account for the different levels of creativity between Big and Little C perspectives, or unique interpretations of individuals. On the other hand, Mini C creativity attempts to explain how the individual constructs, adapts and reorganises personal knowledge, and Pro C attempts to account for the progression from Little C to Big C. However, both approaches focus predominantly on the creative output and transformation of existing knowledge, without taking into account the many other intricacies, such as the creative process and situational and social forces which contribute to creativity.

#### 2.2.1.3 P's Perspectives

Like Little C creativity approaches, the P's perspectives attempt to give insight into the different facets which shape and define creativity. The most notable structure is the Person, Product, Press and Process framework outlined by Rhodes (1961) which divides studies and theories of creativity into their corresponding category.

The person category identifies the role of personality and traits in the facilitation of creative behaviour. For example, intrinsic motivation is often attributed as being key to a creative personality, with creative individuals most likely to be intrinsically motivated in terms of their interests (Amabile, 1990; Craft, 2005; Stohs, 1992). The process perspective examines creativity in terms of the creative output and how it is assessed by experts in its domain (Amabile, 1982; Baer & McKool, 2009), similar to Csikszentmihalyi's (1996) systems perspective where creative ideas may then influence a particular field and subsequently have an impact on the wider domain. The press perspective looks at how creativity is shaped through situational factors such as autonomy, freedom, resources such as time, encouragement and good role models (Amabile & Gryskiewicz, 1989; Witt & Beorkrem, 1989). The product perspective focuses on the outputs and outcomes of the creative process such as paintings, films or designs and is mostly aligned with conceptualisations such as Big C eminent creativity. Newer additions to P's perspectives includes the persuasion, potential and performance perspectives. The persuasion perspective was offered by Simonton (2000) and refers to the ability of creative individuals to change how others think. Runco (2008) suggested that creativity could be organised into perspectives on creative performance versus creative potential, with the former comprising of theories which focus on manifestations of creativity such as the product and persuasion perspectives, and the later focusing on the more ambiguous perspectives of creativity such as personality, place and process.

There have been some notable criticisms of P's perspectives. For example, as Watson (2007) points out, the P's perspective does not attempt to explain the links between the P's. For example, how would learning in an idea generation workshop (process) in a particular place affect the environment (press), the creative abilities of the individuals (person), the quality of the creative outputs (product) and the acceptance of creative ideas within the social millieu (persuasion)? While the P's perspective attempts to shed light into how creativity occurs at the levels of the person, product, place, press, process and persuasion, it does little to illustrate how these factors interact in the facilitation of creativity (Watson, 2007). Furthermore, the P's perspectives assume creativity is a solitary act or process and leaves much to be explored in terms of how creativity occurs within groups or teams.

### 2.2.1.5 Creative Cognition

The creative cognition approach to creativity is based on the experimental methods of cognitive science and psychology which aim to explicate the unique processes and structures that contribute to creativity. Originally, creativity had been measured in the cognitive and psychological sciences using traditional psychometric approaches which rely heavily on divergent thinking tests as indicators of creativity. However, it has been argued that divergent thinking is too broad a construct to be measured by one test alone, and in fact can encompass a much larger variety of processes such as episodic retrieval (e.g. recalling past uses for items), mental imagery (e.g. analysing a mental image of an object and picking out features of the object which could be utilised) and abstraction (e.g. interpreting an object as having an alternative use). In essence, divergent thinking can involve a multitude of other processes which are far more complicated to accurately assess (Ward, 2007). As such divergent thinking tests are criticized as being not accurate measures of actual, real-life creativity and as such were more suited to a measure of creative potential rather than actual creativity (Runco, 1993).

Originally based on the Geneplore model of creative functioning (Finke et al., 1992) which proposed that creativity takes place through an initial phase of idea generation (known as the "preinventive" phase), followed by a phase of extensive exploration where ideas are refined and reflected upon, taking into account wider constraints and limitations. See figure 1 for illustration of the Geneplore model.

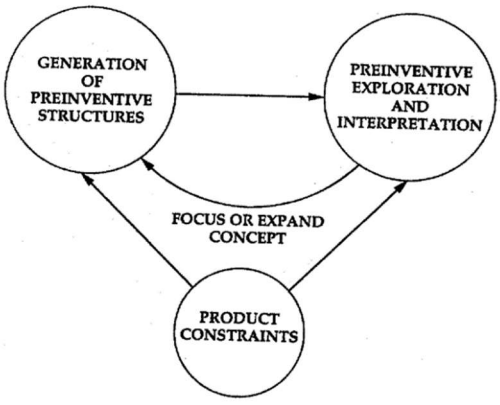



*Figure 1: Basic Structure of the Geneplore Model (Finke, Ward & Smith, 1999, pp.193)*

Unlike other conceptualisations of creativity such as Big C approaches, creative cognition rejects the idea that creativity is a result of savant minds and is not solely focused on creativity as a product or a process. Instead proponents of creative cognition argue that "ideas and tangible

products that are novel and useful are assumed to emerge from the application of ordinary, fundamental cognitive process to existing knowledge structures" (Ward, 2007, p. 28).

The creative cognition framework identifies a range of processes, both generative and exploratory, which contribute to creative ideas and products. Generative processes include but are not limited to a combination of cognitive structures (Baughman & Mumford, 1995; Hampton, 1987), mental synthesis of new structures (Thompson & Klatzky, 1978), transformation of existing structures (Shepard & Feng, 1972) and analogical transfer of information to different domains (e.g. Gentner, 1989). Examples of exploratory processes include looking for metaphorical associations of structures (Ortony, 1979), function identification of structures (Finke, 1996), interpretation of possible solutions from structures (Shepard, 1978) and identifying practical or conceptual limitations (Finke et al., 1992).

The creative cognition approach expands to include theories on creative insight (the sudden realization of a solution, e.g. Schooler and Melcher, 1995), incubation (a period of rest away from the problem, e.g. Hélie & Sun, 2010; R. K. Sawyer, 2013) and creative problem-solving (e.g. Mayer, 1983; Treffinger, 1995). Many of the processes associated with creative cognition may be inherent in the different forms of creativity in games – for example the exploratory process of identifying practical and conceptual limitations could relate to testing of game boundaries within a game to determine acceptable forms of action. Furthermore, other creative cognition theories such as incubation could account for the generation of solutions following taking a break in gameplay.

### 2.2.2 Creativity in Digital Games

Many have argued that games can provide opportunities for the development of creativity and innovation skills within a situated and active context involving holistic problem-based environments with optimal challenges and immediate feedback (Boyle et al., 2011; Gee, 2005; Lu, 2013; Van Eck, 2006). Moreover, it has been suggested that digital games may actually increase creative ability (Jackson, 2012; Jackson et al., 2012) with "video game playing increase[ing] creativity, directly or indirectly, mediated by its beneficial cognitive, social, emotional and motivational effects" (Jackson & Games, 2015, p. 30).

While games adhere to many of the constructivist principles which encourage creative behaviour, it has also been argued that individuals who are already creative may be inherently drawn to digital games (Bowman et al., 2015). For example, Ventura et al. (2012) found that those with higher openness to experience scores (a trait linked to divergent thinking) and domain unspecific creativity were more likely to play a variety of different digital games. Similarly, Sherry

et al. (2006) found that those with creativity related skills (e.g. critical thinking, problem-solving) were more motivated to play digital games in the first place.

While there may be a link between creative individuals and gaming activity, there remain questions in relation to whether individuals become more creative from playing games, and hence, engage in other creative activities, or whether they were inherently creative to begin with. Similarly, there remains a grey area as to exactly why creative people are drawn to games in the first place. Similarly, exactly what constitutes a "creative person" is still very much a grey area – for example, as in the case of the studies above, is a creative person someone who solely engages in creative activities? What about those who perhaps do not actively take part in activities commonly deemed creative, but nevertheless, self-identify as being creative people?

While few studies have looked exclusively at creativity in games, by reviewing literature which included creativity in games, three predominant categories emerged: creativity as problem solving, creativity as appropriation and creativity as affective change. In creativity as problem-solving, creativity encompasses the cognitive processes which occur during the solving of ill-structured problems. In creativity as appropriation, creativity encompasses how players construct their own meanings from games and negotiate the ludic boundaries imposed by designers. Finally, in creativity as affective change, creativity encompasses the personally meaningful interpretations of a game, as well as changes in viewpoints and beliefs as a result of playing a game.

#### 2.2.2.1 Creativity as Problem-Solving

Problem-solving has been argued to be central to creativity, with a "problem representing a gap between where we are or what we have, and a desired location or outcome" (Treffinger et al., 2007, p. 1). In this light, problem solving can be defined as "the thinking and behaviour we engage in to obtain the desired outcome we seek" (Treffinger et al., 2007, p. 1). Creative problem-solving is focused on problems which are ill-structured; meaning they can be solved in multiple different ways. Ill-structured problems have been claimed to provide a more meaningful learning experience as they offer opportunities to use different problem solving strategies (Papert, 1993). However, it has been pointed out that creativity is both reactive and proactive, hence while creativity facilitates problem-solving, it can also aid in avoiding problems in the first place (Heinzen, 1994).

Games themselves can be considered big problems, comprising of many different casually linked problems. According to Kiili (2005), a problem in a game can be considered anything which restricts a player's progress. Problem solving can be associated with discovery learning, where a learner is able to discover new ideas and rules, rather than memorizing abstract concepts. It has

been suggested that games are especially good at fostering this kind of learning. For example, Leng et al. (2010) argued that the gameplay process facilitates the development of problem solving and creativity through allowing the learner to link abstract concepts to concrete gaming experience to solve problems. Similarly, Hsiao et al. (2014) found that through engaging in problem solving which required the exploration of different combinations of in-game skills and abilities, creativity was enhanced.

In addition to ill-structured problems facilitating creativity, they may also contribute to flow experiences (Kiili, 2005; Voulgari et al., 2014) which have been argued to be an antecedent to creativity (Csikszentmihalyi, 1996). One way of viewing this possible relationship is through experiential learning. Experiential learning stresses the importance of direct experience and reflective observation. The function of games to act as a means for players to test and reflect upon their actions can be illustrated by Kiili's (2005) Experiential Gaming Model (EGM) (Figure 2). The EGM describes learning in games as an experiential process facilitated by the flow state.

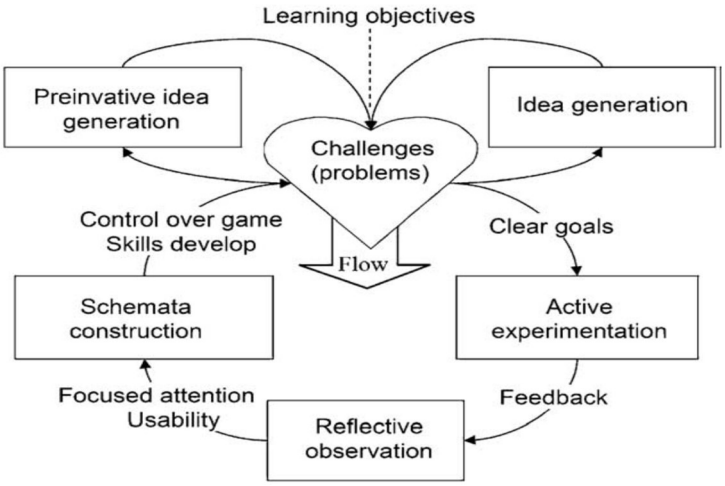



*Figure 2: Experiential Gaming Model (Kiili, 2005, p.6)*

The challenge bank maintains player motivation and engagement by pumping out appropriate challenges. In response to these challenges the player creates solutions in the "Ideation Loop" which is divided into two types of idea generation similar to that of the Geneplore Model of creative cognition (Finke et al., 1992): "preinvative" idea generation and idea generation. In the former, the creativity takes place in a chaotic and unstructured phase similar to the play of young children, where the player does not take into account the wider milieu of constraints. After this phase, the ideas are refined further regarding the wider constraints,

resources and limitations of the game world. This secondary phase of idea generation is most fruitful if performed in groups, suggesting that flow within a social context may play an important role in idea refinement. Through reflective observations, guided by flow dimensions such as immediate feedback, the player is able to overcome ill-structured problems through the discovery and creation of novel solutions (Kiili, 2005).

The EGM illustrates how ill-structured challenges facilitate creative problem-solving, however, it was originally designed to be used in educational game design. While other theories and models which were designed for educational means may not be wholly applicable to commercial entertainment games, the EGM is fairly general in scope (i.e. ill-structured problems are apparent in many games, whether educational or not) and, thus, could be used to analyse creative problem-solving in the majority of digital games.

The idea that reflective thinking and observation constitute core components of learning can be mirrored in literature on creative thinking. For example, Henriksen (2006) argued that reflection is a means for transferring knowledge cross-contextually and aids the creative application of knowledge onto new problems. They argue that games have the potential to facilitate reflective thinking through the process of accommodation. The process of accommodation refers to the altering of an individual's personal interpretative frame when it is challenged by contradictory knowledge (von Glasersfeld, 1995). The accommodation process can take place in games through the act of role play in situations which would otherwise be inaccessible. Due to this, games give the unique opportunity to allow individuals to actively experiment and participate in different contexts, creating opportunities for the restructuring of existing knowledge (Henriksen, 2006).

One other way in which games facilitate creativity from a problem-solving angle is through gameplay "breakdowns" which refers to instances where gameplay is interrupted (Barr et al., 2007) such as when a player cannot find the correct strategy and becomes "stuck" at a game, or where the route to progression is not clear. Often instances which lead to gameplay breakdowns can instigate the formulation of new strategies. Blumberg et al. (2008) looked at how adult gamers manage to navigate impasses in games and characterised an impasse as "a gap in prior experience or lack of knowledge necessary to solve a given task" (Blumberg et al., 2008, p. 1531). It has been claimed that games are adept at fostering impasse-learning (Driskell & Dwyer, 1984) which is facilitated by the resolution of such impasses through problem-solving (Jones & Vanlehn, 1994; Vanlehn, 1988; VanLehn et al., 2003). Using a think aloud study where participants played *Sonic the Hedgehog 2* for Game Gear, Blumberg et al. discovered that those who played digital games more frequently referenced insight and potential strategies more frequently than those who played infrequently. Moreover, as game performance increased across all participants,

so did the number of comments relating to game strategies and insight, suggesting that gaming impasses facilitated opportunities for players to both re-assess and re-evaluative existing strategies and formulate new ones. Blumberg et al.'s study illustrates how gameplay breakdowns can lead to an increase in gaming ability, and subsequently the number and type of strategies used. However, Blumberg et al. used only one type of game in their study and hence their findings may not be as applicable to different game genres.

Within a series of case studies, Iacovides et al. (2015) examined how players navigate gameplay breakdowns and learn through play by achieving breakthroughs in understanding. Unlike Blumberg et al. (2008), participants played a game of their choosing allowing different game genres to be observed. Iacovides et al. identified three types of breakdowns: actions, understanding and involvement. On the action level, breakdowns occur when a player fails to be successful in performing a specific action. On the understanding level, a breakdown can occur when the route to progression is not clear, or where the player is unsure of what they are supposed to do. On the involvement level, a breakdown occurs when the player experiences frustration or boredom. In a set of additional studies (Iacovides et al. 2014), examining single-player and co-located games, players were seen to develop a range of different strategies when they experienced breakdowns. These included strategies such as "trial and error" which consisted of the player exploring game boundaries and experimenting and reflecting upon actions, "stop and think" which consisted of taking a short break from play prompting reflection on the problem, and "experiment" where the player uses previous gaming knowledge (often gained from "trial and error") to form an initial hypothesis and then refines the hypothesis based on the outcome. Similar to Blumberg et al. (2008), Iacovides et al. (2014) found that the strategies players adopted often related to their gaming experience, and additionally, the type of game played. However, as the authors point out, while some of the games were co-located, none of the cases involved participants engaging in online or competitive contexts and hence do not account for any strategies which may occur in such games (Iacovides et al., 2014).

In essence, through providing optimal challenges, the learner is able to make observations, form hypotheses and actively experiment with ideas in new situations and contexts. In this way, learning is a continuous and self-directed process with appropriate and immediate feedback providing the foundations for goal-directed action. The process of tackling ill-structured problems via experimentation with different ideas and strategies has been argued to be a core component of creativity (Hsiao et al., 2014; Kiili, 2005b; Leng et al., 2010; Voulgari et al., 2014). While attention has been paid to experiential learning and problem-solving in terms of educational games, it has yet to be fully explored a) in relation to learning which takes place in entertainment games and b) in relation to the role it may play in player creativity.

#### 2.2.2.2 Creativity as Appropriation

While creativity in games can be viewed from a cognitive standpoint, focusing on novel solutions to ill-structured problems, another way to view game-based creativity from the literature is as a form of appropriation. Digital games can allow a range of player created experiences which both sustain intention to play and attract new players (Lee & Tsai, 2010). Appropriation can be defined as "the process by which users adopt, adapt and incorporate technology in their practices, work, or leisure" (Herodotou et al., 2012, p. 34). Game appropriation includes both modification and creation of game (or game-based) content, as well as how players can make novel, and often unintended, uses of game mechanics.

Burri (2011) defines user created content (UCC) as "all forms of expression made by users [which] range from contributions to chats, email or instant message exchanges, shared links, texts, videos and photographs created from scratch authored stories and films" (Burri, 2011, p. 3). It has been argued that UCC can be considered a new form of play which aims to expand game affordances beyond their original design (Burri, 2011). Due to the rising popularity of open-world games and MMOGs, games have become more adaptable and flexible in allowing players the freedom to experiment and act creatively (Burri, 2011). Burri (2011) outlines three categories of UCC based on the ludic restrictions of the game. In the first category, many older games such as *Pong* (Atari, 1972) or *Pac-Man* (Namco, Atari, Brains, & Namco Networks, 1980) allow the user to only act as consumer, affording little to no creative potential. The second category refers to games which involve the possibility of UCC, however, the game itself restricts this to allowing players to create either on top of or parallel to game content, but unable to create anything new or original. MMOGs such as *World of Warcraft* (Blizzard Entertainment, 2004) fall under this category. The third and final category involve games which are largely shaped and defined by UCC such as *Second Life* (Linden Labs, 2003) and *Minecraft* (Mojang, 2011). In this category, not only does UCC create game content but it also functions to promote the trading of the created content.

There can be problems when it comes to games and virtual worlds which have very low levels of ludic restriction. Lastowka (2005) argues that virtual worlds which lack game structure can be problematic for some players who do not know what the technology should be used for. In virtual worlds and games which lack clear objectives users may turn to potentially dangerous and exploitative uses of UCC such as scamming virtual currency and gambling. Essentially when the "game" element is removed from virtual worlds such as these, players may still treat them as

games, however, the "game" played may be unclear and unappealing to new users (Lastowka, 2005).

Aarseth's (2007) concept of *transgressive play* is one way to view the distinction between how games are intended to be played, and how players actually engage with them. Aarseth distinguishes between the "implied player" which can be viewed as a blueprint of what is expected of a player in a particular game and includes all the requirements which must be met for the game to be fully realised. For example, the player must interact with the user interface in a certain way to reach the inventory screen or must complete one task before the next part of game is available. On the other hand, there is the "transgressive player" which refers to instances where players are able to do unexpected things, or as Aarseth puts it: "they are not part of the game's intended repertoire, and would in most cases have been rendered impossible if the game designers could have predicted them" (Aarseth, 2007, p. 132). Through engaging in instances of transgressive play, the player is able to rebel "against the tyranny of the game…[and] regain their sense of identity and uniqueness through the mechanisms of the game itself" (Aarseth, 2007, p. 132).

Similar to Aarseth (2007), Schäfer (2011) distinguishes between two types of participation in technology: implicit and explicit. Implicit participation refers to user actions which fit within the constraints of a technological medium, such as object creation in *Minecraft* or avatar creation in *World of Warcraft.* However, explicit forms of participation involve the creation of something novel or active engagement in the development process (Schäfer, 2011). As such explicit participation is action which was not *intended* by developers such as the interaction of different game variables, or the creation of fanfiction, and involves testing the limits and capabilities of the game rules. Explicit participation can be seen in games which have a higher level of ludic restriction such as MOBAs. For example, Jarrett (2014) examined co-creativity in *Dota 2* (Eul et al., 2003) and its contribution to emergent forms of play. *Emergent gameplay* "refers to the development of something complex from simple constituent parts….[and] is usually associated with players' freedom to use different strategies, and especially with unexpected and surprising behaviour" (Sotamaa, 2007, p. 386), and is argued to be particularly relevant to open-ended and non-linear games. The "Fountain Hook" move in *Dota* 2 can be cited as an example, involving a unique and unintended combination of game variables such as different hero abilities, items and perfect timing, which resulted in a deadly move that could completely wipe out the other team.

However, as Sotamaa (2007) argues, emergence may be used loosely and there is little consensus on whether emergence is a feature of the game system or resulting from unintended player behaviour (Juul, 2005). Instead, Sotamaa argues that the term *transformative play* may be used which refers to "a special case of play that occurs when the free movement of play alters the

more rigid structure in which it takes shape" (Salen & Zimmerman, 2004, p. 324) and can be applied to interpret games as systems which are able to be manipulated, sometimes unexpectedly, by players. Unlike emergent gameplay, transformative play is not solely restricted to gameplay itself, but can also apply to the transfer of elements of play from the gameworld to outside, such as in the case of fan creations involving elements of technology in ways not initially intended by developers (e.g. *Machinima* where animated films are created using games) (Sotamaa, 2007).

Just as players creatively combine game variables, they can also create new uses for existing game mechanics. Wright et al. (2002) examined creative player actions in first person shooter (FPS) MMOs and found that players used a variety of verbal and non-verbal expressions which went beyond the standard game rules. For example, in their category of "Creative Game Talk", they found that players of *Counter-Strike* (Valve Corporation et al., 2000) were able to use the game's mechanic which allowed players whose avatars had died to view the game from the perspective of those still alive, to aid in giving tactical advice. Furthermore, these players (who were unable to communicate via the normal chat channels) also used the technical feature of calling for votes (where players could vote on which map to play) to send messages to the rest of their team, warning them of potential ambushes and areas to avoid. In this way, players are able to "bend" the conventional rules through creative innovation (Wright et al., 2002).

While the literature above has examined certain aspects of appropriation, Hamlen and Blumberg (2015) identified four ways in which players could "cheat" creatively. While cheating may be associated with dishonesty and unfair behaviour in other areas of life, cheating in the context of digital games "may be seen as breaking of rules established within the game or by the game community or as an expected activity given the conventions of game play" (Hamlen & Blumberg, 2015, p. 85). They identified several methods of cheating working both *within* and *outside* the programming of a game, such as identifying unorthodox solutions to problems using the features built into the game, taking advantage of "quirks" and unintended outcomes developers didn't consider, and altering the programming of a game through hacking. While such cheating requires a significant level of creative problem-solving and out-of-the-box thinking, it is noted that with hacking the creativity may be limited in the case of players simply downloading hacks or mods (modifications which alter or add to game content) which other players have created.

While the previous research reviewed above describes various aspects of appropriation in relation to UCC (Burri, 2011), unintended uses of game mechanics (Aarseth, 2007; Jarrett, 2014; Juul, 2002; Sotamaa, 2007), malevolent behaviour (Griffiths & Light, 2008; Lastowka, 2012) and cheating (Hamlen & Blumberg, 2015), it does little to enlighten us in terms of *how* appropriation

in games come about in terms of game elements and individual player characteristics. One model which does attempt to explain the process of game appropriation is the Game Appropriation Model (GAM) (Herodotou, 2009; Herodotou et al., 2012) which was developed from three studies involving questionnaires with 73 undergraduate students and semi-structured interviews with three students, an online survey with 1051 gamers and semi-structured interviews with 13 gamers. The GAM illustrates that game appropriation operates over two levels: group and individual, comprising of five main characteristics. See figure 3 for illustration of the GAM.

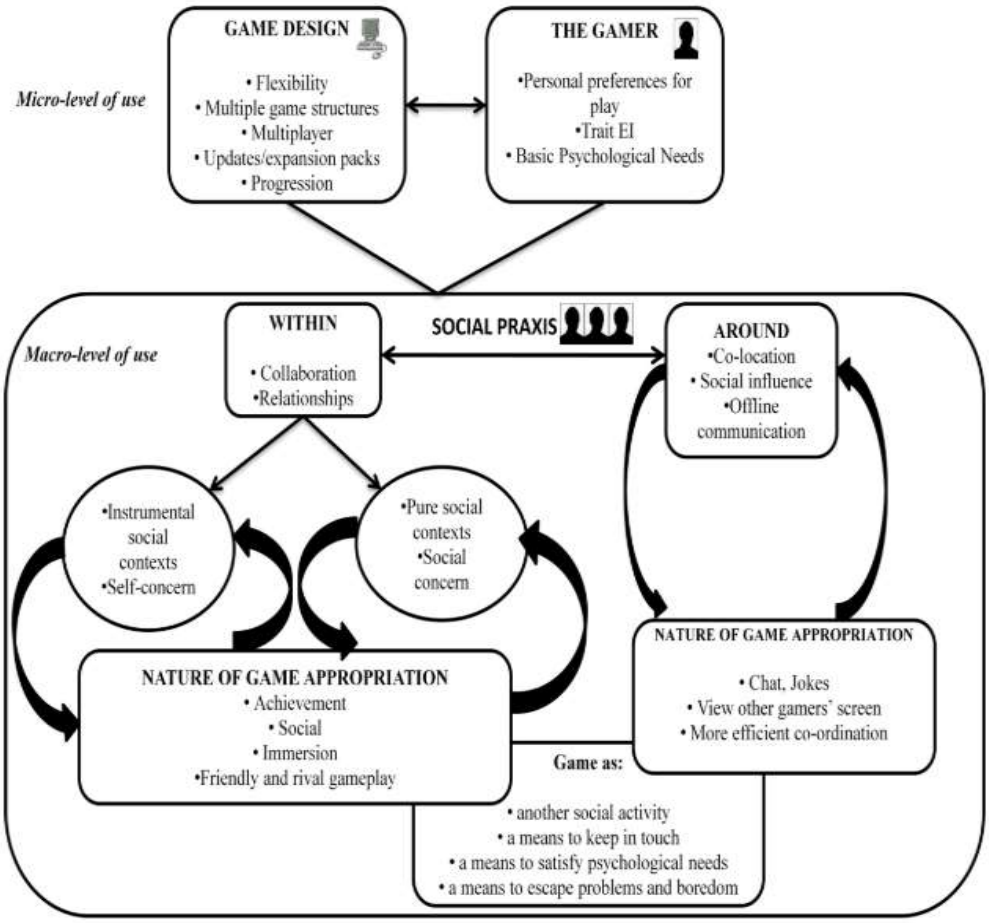



*Figure 3: The GAM IV* (Herodotou, 2009, p. 251)

On the individual level are the characteristics of personal preferences for play and individual differences. In personal preferences for play, appropriation is shaped by the player's preference for particular playstyles, as well as how they appropriate social praxis to create a personal form of play. On the group level is the characteristic of social praxis which is defined as "a special demonstration of sociality or social interaction" (Herodotou, 2009, p. 254) where players coordinate and collaborate in order to achieve common goals.

Appropriation is further influenced by game design which includes affordances for flexibility, multiple game structures, multiplayer orientation, renewal of the gaming experience through updates and progression. Game design which offers greater paidic flexibility (i.e. are less rule bound) affords greater personalisation and creativity from players such as the implication of modifications on the game structures such as the game interface and on the formation of in-game relationships. Multiple game structures offer further possibilities for play such as sidequests, variety of item and abilities, and open-ended routes of play. Multiplayer orientation allows innovative forms of play through collaboration with other players to tackle difficult challenges. Renewal of the gaming experience is maintained through updates and patches which offer new content and choices, and players are given a sense of progression through the process of levelling and acquiring more powerful items (Herodotou, 2009). These elements of game design allow players to experiment with and combine different routes of play, strategies, item combinations and the creation of different avatars.

The GAM provides a detailed foundation of the different components which shape game appropriation, however, as Herodotou et al. note game appropriation is genre-specific and "game appropriation can be examined only when focused on a single game genre and the unique practices surrounding its use" (Herodotou et al., 2012, p. 45). While the initial study of the GAM involved those who played a variety of different digital games, the subsequent second and third studies which refined the GAM were based on players from the MMORPG *World of Warcraft* (Blizzard Entertainment, 2004). As such, the large social component of the GAM may not be as applicable to offline single player games, and other MMO game genres. As such an exploration of how appropriation may manifest within different game genres and offline, single player games would help extend the focus of the model to a wider variety of games. Furthermore, the GAM was developed to account for one form of creative expression: appropriation, and as such does not provide a holistic account of the different forms of player creativity.

#### 2.2.2.3 Creativity as Affective Change

Creativity as affective change is derived from Kaufman and Beghetto's (2009) Mini C conceptualisaiton and is usually a result of engagement with a game's narrative. Unlike Little C perspectives which examine how individuals are able to solve everyday problems in novel and inventive ways, Mini C is defined as the "novel and personally meaningful interpretation of experiences, actions and events" (Kaufman & Beghetto, 2009, p. 3). Games designed to promote affective change are part of the larger area of persuasive computing which examines how technology and digital services can be designed to influence attitudes and behaviours. However, while such games are designed with affective change in mind, the focus of this thesis is on general

entertainment games which do not have explicit goals of affective change and as such the Mini C creativity that occurs is often a by-product of engagement with the game narrative.

Many games have an overarching narrative in addition to numerous choices and options which allows players to form their own subjective stories based on their game experiences. Calleja (2011) argued in his Player Involvement Model that narrative involvement in a game comprises not only the *designed narrative*; the game world's history, background and stories, but also the *personal narrative* of the player. The personal narrative is made up of an accumulation of game-play experiences as well as how the player uniquely interprets the game world (Calleja, 2011). These personal narratives and experiences of players can lead to learning on a personal level such as emotional development, cultural development and changing as a person (Iacovides et al., 2014). By viewing creativity in this way, players are able to form new viewpoints, or change existing ones and create personally meaningful interpretations of a game, both in terms of narrative and mechanics.

Cole et al. (2015) examined emotional and functional challenge in games core and avante-garde games. Using a grounded theory approach, they analysed professional reviews on a series of 14 games from three different categories. The categories comprised unconventional indie titles such as *Papers Please* (3909 LLC, 2013), blockbuster, high budget titles such as *Call of Duty: Modern Warfare 2* (Infinity Ward, 2009) and innovative, experimental high budget titles such as *Spec Ops: The Line* (Yager Development, 2012). They found that a core element of the gaming experience was narrative and story-telling. Cole et al. (2015) distinguished between functional and emotional challenges, with functional challenges referring to challenges which can be overcome with dexterity, skill and strategy. Functional challenges were desired most by players of blockbuster core games and were given the most focus in these reviews. In contrast, reviews of the avante-garde titles mainly focused on the story and how it made them feel. These games confronted the player with emotional challenges which were created by emotionally difficult material, leaving parts of the experience ambiguous, and good story and writing. Emotional challenges were not tackled with dexterity and skill, but required a "cognitive effort not dissimilar to Schopenhauer's notion of the aesthetic experience of the sublime" (Cole et al., 2015, p. 123). It was also noted that the emotions experienced when playing these games showed a greater range and differed between reviewers, with games often invoking a reflective and contemplative state of mind.

Cole et al. (2015) suggest that functional and emotional challenges are often antagonistic to one another. For games high in emotional challenge, functional challenges are often low such as simple controls or repetitive combat, however, by "leaving space for the player to think and contemplate – unburdened by the requirements of completing functional challenges, the player is

better able to emotionally invest, and subsequently receive a greater emotional return, in the diegesis" (Cole et al., 2015, p. 124).

Bopp et al. (2018) took a different approach to the study of emotional challenge by conducting an online survey of 171 players of different types of games. Questions were both open-ended and involved psychometric measures. While the majority of games participants played were triple A titles, Bopp et al.'s found that both functional and emotional challenges were exhibited in some games such as *The Witcher 3* (CD Projekt Red, 2015). It was found games with difficult themes such as death, illness, war or domestic problems were especially emotionally challenging if aspects of the game narrative mirrored that of participants own lives. Often these themes invoked feelings of negative valence such as anger or loneliness, however, it was noted that "by confronting these difficult themes…participants could derive personally meaningful insights" (Bopp et al., 2018, p. 9). Bopp et al. (2018) also found ambiguity proved significant when it came to games which required players to make decisions – games which presented players with choices where there were no clear cut right or wrong answers promoted reflection before and after the choice was made.

Where previous research argued that emotional challenges do not require skill to overcome (Bartsch & Hartmann, 2017; Cole et al., 2015), Bopp et al. (2018) argues that that is not a clear cut area in regards to what is defined as "skill". Skill in relation to the difficult themes presented in an emotional challenge may constitute a player's capacity for reflecting and making meaning of the emotionally challenging situation presented to them, in addition to dealing with the negative emotions they may experience. In addition, despite the negative emotional experiences, it was found that participants rated the overall emotional experience of the game to be positive and enjoyable.

In essence, emotional challenge is particularly relevant to creativity as affective change since it allows players to generate their own personally meaningful interpretations and insights of the game narrative. Emotional challenges can be presented to players using emotionally difficult themes, as well as forcing players to choose between morally ambiguous choices. While work on emotional challenge has illustrated the importance of well-developed narrative and subtlety in presenting difficult themes and choices, we still know little about how such emotional challenges link specifically to game design elements, and if emotional challenges do indeed instigate further affective changes such as beliefs, perspectives and attitudes.

Following on from emotional challenges, another aspect of affective change which has been given little attention is reflection. Reflection has been suggested to be an important aspect of creativity (Henriksen, 2006) whereby reflective thinking occurs through the accommodation of new knowledge, resulting in the altering of an individual's interpretive frame when it is challenged

by contradictory knowledge (von Glasersfeld, 1995). Mekler at al. (2018) examined what constituted a reflective experience in games, and what benefits players derived from these experiences using a qualitative methodology involving semi-structured interviews with 19 players of different types of games. It was found that the process of reflection was enjoyed by most players who felt it added depth to their gameplay experience, and introduced them to new ideas and concepts. Using Fleck and Fitzpatrick's framework (2010) for reflection in HCI, they identified five levels of reflection. The most common instances of reflection involved *non-reflective description* and *reflective description* which related to descriptions alongside factual explanations, evaluations of gaming instances, and combined reflective and non-reflective descriptions. The third category, *dialogical reflection,* which was not as frequently observed, led to revisiting instances of gameplay and working out how to improve, progress, or make parallels between a game and real life. The fourth category, *transformative reflection,* led to changes in behavior, assumptions or gaining new insights. Mekler et al. found very few instances of this level of reflection, with only two participants citing experiences which promoted transformative reflection by drawing parallels from a game to real life and by reflecting on gaming practices. The fifth category of *critical reflection* was not observed; while participants mentioned the ability of games to encourage them to think about ethical and societal issues, their attitudes and perceptions were unaltered.

Mekler et al.'s (2018) study found that through drawing parallels to real life, participants were able to reflect on ethical and societal issues. However, despite the argument that games may act as tools to promote transformative and critical reflection (Khaled, 2018; Slovak et al., 2017), few instances of these types of reflection were found. It is worth noting however, that higher levels of reflection may be extremely rare, with previous work on reflection in HCI finding scant evidence of transformative and critical reflection (Fleck, 2008; Fleck & Fitzpatrick, 2010; Ganglbauer & Fitzpatrick, 2015). The lack of instances of transformative and critical reflection observed could also be due to the fact that the majority of participants in the study played core games which did not solely focus on prompting reflection in players. A more recent study by Whitby et al. (2019) based on open-ended online questionnaires completed by 101 respondents also found little instances of deeper level reflection, however, there were a significant number of *endo-transformative reflections.* While these reflections did not involve deep belief changes in relation to society, self or culture, they did involve changes in the way players perceived aspects of the game such as in-game characters and approaches to gameplay. In this way, the affective change is not solely instigated by deep reflective moments but also by the more "mundane" levels of reflection such as endo-transformative reflection which still prompt changes in perception in relation to aspects of the game (Whitby et al., 2019).

While creativity as affective change may be facilitated by a game's narrative structure in

terms of providing emotional challenges and opportunities for reflection, it can also be instigated from a social perspective such as in the case of online gaming communities. Through participation trajectories, players take on community values and practices and shape aspects of their identity and beliefs (Oliver & Carr, 2009). In this way, players are both creating and experimenting with identities which are shaped by membership of communities and personal narratives. An example of this could be illustrated by Lee and Hoadley's (2007) study which looked at how identity and cultural development can take place through experiential learning in MMOs. They found that through experimenting with different identities, high school students were able to solve problems from the viewpoint of the roles they took, as well as gaining new perspectives and challenging them to think in different ways. At the end of the experiment, the high school students had a wider perception of cultural diversity and were highly enthusiastic about using MMOs as learning tools. Lee and Hoadley's study illustrates how gameplay elements such as affordances for customisation provide opportunities for players to experiment and reflect upon different identities, promoting changes in viewpoints and perspectives.

### 2.2.3 Creativity Defined

There exists a great number of conceptualisations and theories in relation to creativity and while it is beyond the scope of this thesis to provide a full account of the all of these, some of the most common approaches have been discussed. In relation to the literature discussed, this final section will posit a definition of creativity to be used in the context of this thesis.

The eminent works of creative genius and domain changing inventions have been examined from Big C approaches, while the smaller Little C creative efforts of individuals in everyday life have been argued to involve tackling everyday challenges and problems. The dichotomy between Big and Little C approaches have given rise to a number of arguments, namely that these two approaches do not account for all the different creative efforts in between. Perspectives such as Kaufman and Beghetto's (2009) Mini C attempt to address this by looking at the novel and personally meaningful interpretations of events, experiences and actions. Similarly, work by Lister et al. (2003) and Leadbeater and Miller (2004) attempt to bridge the divide by merging the work of producers with consumers.

Other approaches have viewed creativity as a multi-faceted construct such as the P's framework (Rhodes, 1961) which accounts for creativity from the product, person, press and process perspectives. Additional perspectives include the persuasion, potential and performance (Runco, 2004; Simonton, 2000). However, some notable criticisms of P's perspectives include the

fact that they do not account for the interaction of different creative factors in the facilitation of creativity, nor do they account for how creativity can occur within groups (Watson, 2007).

The majority of creative approaches discussed examined creativity from a top-down perspective. The creative cognition approach (Finke et al., 1992) takes a bottom-up perspective and examines the particular cognitive processes which contribute to creativity. Creative cognition does not focus on creativity as a product or process but instead as a set of mental structures which contribute to the various stages of creativity.

In terms of digital games, traditional approaches to creativity have seldom been used to explore player creativity, apart from in the case of Kiili's (2005) Experiential Gaming Model which outlines how games promote experiential learning through problem-solving processes, facilitated by flow. This gives rise to the question of whether traditional approaches are appropriate to conceptualise creativity in digital games? And how do these traditional approaches align with how players themselves conceptualise creativity?

In addition, some games can be argued to be more structurally open than others in terms of allowing players freedom on how they wish to play. Appropriation can take a variety of different forms such as the creation of UCC (Burri, 2011), emergent (Jarrett, 2014), transgressive (Aarseth, 2007) and transformative (Sotamaa, 2007) forms of play, the creation of social innovations and conventions (Wright et al., 2002) and creative cheating (Hamlen & Blumberg, 2015). However, the different game formats impose varying degrees of ludic restriction. While there is emerging work in the area, there are still questions around how appropriation is expressed within a) different game genres, and b) games of varying ludic restraint.

Some work has been carried out on the emotional effects which games may have on players through providing emotional challenges (Bopp et al., 2018; Cole et al., 2015) and opportunities for reflection (Mekler et al., 2018). While serious games and Games for Change are designed with affective goals in mind, entertainment games also provide players with emotional challenges, opportunities for reflection and options for experimenting with different identities and personalities. However, there is still little empirical evidence of entertainment games facilitating affective change. As such, questions remain around whether entertainment games can promote lasting affective changes, and how games may affect and influence attitudes, behaviours and viewpoints in other areas of life.

While creativity has been examined in digital games, albeit largely indirectly, there is still a significant lack of literature which outlines the different ways creativity is expressed in games. Similarly, it is unclear how different types of digital games contribute to different forms of creativity.

In conclusion, there is no definitive conceptualisation of creativity – the creative processes involved and the ultimate form the creative action may take is highly dependent on the context in which it is occurring and the traits of the creative individual. Creativity can arise from the macro-level creations of game developers, the community creations of players, and the unique interpretations of a game's narrative, story and structure. Creativity is not solely restricted to within the game itself, but instead can flow between the game world and other areas of life as can be seen in fan creations and modding. As such, a looser definition of creativity will be used in the context of this thesis and will combine various traditional approaches to provide a contextually fluid lens in which the various facets of player creativity will be highlighted. Hence:

> *Creativity involves the formulation of new ideas as well as novel application of old ones, the creation of artefacts and knowledge, and the stretching and altering of mental boundaries in thinking, reasoning and emotion. Hence, creativity does not encompass merely inventing, it also involves altering and integrating. It is both an outcome in itself as well as a process leading to the development of abilities and learning. It is fluid and depends as much on the individual as the context in which it takes place. Problem-solving is often at the heart of both big and small creative acts and can serve as a foundation for the discovery of new ideas, methods or viewpoints.*

## 2.3 Learning from Creativity

While creativity has been argued to contribute to a variety of positive outcomes, one such outcome is successful and meaningful learning (Ferguson, 2011; Mishra et al., 2013). In this way creativity plays an important part in facilitating learning. For example, Vygotsky (2004) argued that creativity plays an crucial role in children's general development and maturation: through play children are able to try out different identities in a "creative reworking of the impressions [they] have acquired" (Vygotsky, 2004, p. 11). It has been suggested that creativity is instrumental to lifelong learning and contributes to the development of knowledge for the improvement of society (Ott & Pozzi, 2012). Furthermore, the relevance of creativity in academic performance has been highlighted by studies such as Rogaten and Moneta's (2017) which found that cognitive aspects of creativity were indirectly positively correlated (mediated through positive affect) with increase in academic performance. In this way, creativity serves as a facilitator for the construction of knowledge, skills and abilities.

Games can provide an effective learning experience which fosters the development of creativity and innovation through situated and active learning within complex, holistic problem-based environments, promoting collaboration through optimal challenges and immediate feedback (Boyle et al., 2011; Gee, 2005; Lu, 2013; Van Eck, 2006). In this way, games not only provide a medium in which players are able to express and develop their own creativity, but also provide an opportunity for subsequent learning from the creative process – for example, creating strategies (e.g. creativity as problem-solving) may also develop a player's critical thinking and motor skills. The propensity of games to provide opportunities for creative behaviour and subsequent learning has been argued to be based upon four constructivist principles: firstly, active learning instead of purely abstract and instructional techniques. Secondly, the capability of games to create satisfaction and personal motivation in learners. Thirdly, the capability of games to accommodate different learning styles and skill levels. Fourthly, the capability of games to reinforce mastery skills and to provide learners with interactive and contextual decisions (Charles & McAlister, 2004; Holland et al., 2003; Sheffield, 2005).

The next section (2.3.1) will focus predominantly on informal learning in digital entertainment games; namely what areas of learning have been identified by previous work. While the literature in this section is not concerned primarily with creativity, it does provide an indication as to what types of skills and knowledge players may gain from games *in general*. Player creativity may have played a significant part in the development of certain learning outcomes, however, as this was not accounted for in the majority of studies, no conclusions can be drawn. The following section (2.3.2) will examine literature on the transferrable nature of creativity, and transferrable learning outcomes.

### 2.3.1 Informal Learning in Digital Games

Unlike traditional methods of formal pedagogy, the learning which occurs within many digital entertainment games can be described as informal and incidental. In contrast with formal learning, which can be defined by Coombs and Ahmed (1974) as an "institutionalised, chronologically graded and hierarchically structured education system, spanning lower primary school and upper reaches of university" (Coombs & Ahmed, 1974, pp.8), informal learning involves situations which occur spontaneously such as in everyday life where the learning is less structured and participation is voluntary (Eshach, 2007; Gerber et al., 2001). Whereas in school the management and direction of learning is usually governed by the teacher, in informal learning settings the onus of defining the learning path is placed on the learner and as such the motivation to engage in the activity is intrinsic (Csikszentmihalyi & Hermanson, 1995).

While there is no work to the author's knowledge which specifically examines informal creativity in games, it may be that much creative behaviour in gameplay happens incidentally (e.g. the player is not immediately aware they are being creative). In this way creativity may play a large part in subsequent informal learning. While not specifically examining the role of creativity in the learning process, a moderate amount of work has been conducted into what players may learn informally from entertainment games.

One area where the potential of entertainment games to be used as informal learning tools is in the case of second language (L2) learning. Using a Grounded Theory approach (Glaser & Strauss, 1967), Bytheway (2015) collected data from gameplay observations, gameplay recordings and interviews in order to find out what L2 vocabulary strategies were used by ESL students playing the MMORPG World of Warcraft (Blizzard Entertainment, 2004) and how these compared to strategies and taxonomies in other contexts. She found that participants deliberately chose to play on English servers and interact in English. Some additional strategies included looking up words in Google, asking other players for explanations of words (and giving explanations once they had mastered the word), receiving and giving feedback and equating images with corresponding words (Bytheway, 2015).

While Bytheway's (2015) study illuminates the potential for MMORPGs to be used as L2 learning environments, the number of participants was low and gender biased (6 male students). Additionally, the participants selected were all experienced players of World of Warcraft which raises the question: would less experienced gamers deliberately choose to engage in L2 learning in a MMORPG, and if so, would they use the same strategies? Despite the drawbacks of Bytheway's (2015) study, Chik (2014) found similar L2 strategies used in her study of Chinese students using digital games for L2 learning. She used a multiple case study approach, collecting data from interviews, blog entries, L2 histories, recorded gameplay sessions, forums and

stimulated recall sessions to examine how gamers practised autonomous learning in online game communities. It was found that while much of the L2 learning taking place was incidental, some students turned the informal game environment into one for intentional learning; using digital games to supplement L2 language at school. Like Bytheway's (2015) study, it was found that students deliberately chose to play on English servers to practise the language (Chik, 2014).

In essence, while the majority of entertainment games are not specifically designed with clear learning goals in mind, they can be utilised as both informal and intentional learning tools for L2 learning. However, this gives rise to the question of what else can players learn from engaging in gameplay within such games? While it could be argued that the L2 strategies used by players were examples of creativity as problem-solving (e.g. the problem was learning English as a second language and players were able to create various strategies to achieve this), neither studies considered the role of creativity in the learning process. As such forms of creativity such as appropriation were not examined in their relationship to learning.

Apart from L2 learning, the majority of skills and knowledge gained whilst playing can be characterised as incidental. Incidental learning takes place as a by-product of engaging in another activity, or as learning one stimulus whilst paying attention to another (Hulstijn, 2002; Schmidt, 1994). Digital games require the player to engage in multiple activities that require a variety of different skills; from hand-eye coordination, problem solving and team management skills. Unlike the case of L2 learning in which the player is able to create specific, intentional learning goals within an informal environment make measurement easier, incidental learning is more challenging to evaluate and define, as often the player is unaware of the skills they are acquiring or improving. Skills such as hand eye coordination and reaction times can be argued to be gained through implicit competence in incidental learning activities, where the player is not focused on the internalisation of a particular skill and instead that skill is stored unconsciously and used automatically without explicit control (Paradis, 1994).

The implicit development of motor skills such as these could be facilitated through the expression of creativity as problem-solving, such as in games which involve high functional challenges (Cole et al., 2015) which are overcome with dexterity, skill and strategy. Furthermore, problem-solving skills have been argued to be developed through incidental means – for example, Adachi and Willoughby (2013) conducted a longitudinal study involving 1492 adolescents which found that those who played more role-playing and strategy games had higher self-reported problem-solving skills and better academic grades (mediated by problem-solving).

While not focusing specifically on player creativity, Voulgari et al. (2014) created a framework to attempt to categorise informal learning processes and outcomes from players of *World of Warcraft* (Blizzard Entertainment, 2004). Using a mixed-method approach, they

interviewed 22 experienced players using semi-structured and group interviews in addition to conducting a wider online survey of 221 players.

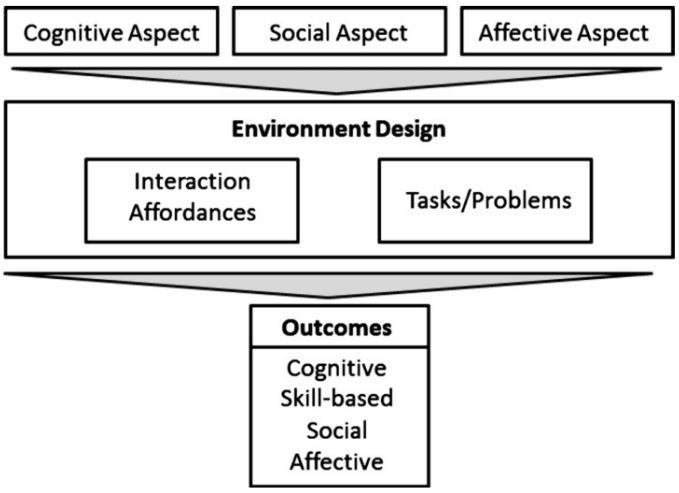



*Figure 4: Theoretical Framework for the Exploration of Learning Outcomes and Processes in MMOGs* (Voulgari et al., 2014, p. 250)

The framework defines learning outcomes as: cognitive, affective, skill based and social. Cognitive aspects were conceptualised as learning outcomes referring to conceptual knowledge such as facts, organizational and strategic knowledge and problem-solving processes. Affective aspects included emotional and motivational impacts of the game environment on players; suggesting a link to creativity in the form of affective change. Skill based outcomes referred to psychomotor skills and kinetic skills synonymous with functional challenges (Cole et al., 2015). Finally, social outcomes related to communication-based aspects such as interaction, attitudes and behaviours towards others.

As discussed in section 2.2.2.1, ill-structured problems have been suggested to create positive conditions for both creativity and learning as they require additional mental and communicative skills (Brown et al., 1988; Greeno, 1978). Interaction affordances refer to the different types of interactions and communications afforded by the game design, such as different chat channels or emotes. Through effective communication within the game environment and during quests/missions, players are able to share goals and responsibilities, which promote an effective collaborative environment for learning.

Voulgari et al.'s framework gives a comprehensive overview of the self-reported learning outcomes and processes in MMORPGs. However, the researchers only examined learning from one type of game, giving rise to the question of whether learning outcomes would differ across different game genres. While they mention that ill-structured problems may facilitate flow, they do little to account for this in relation to learning and creativity. The inclusion of aspects relating to cognitive and affective skills points towards a similarity to the creative expressions of problem-solving and affective change. For example, cognitive related to not only knowledge acquisition,

which could indeed be a byproduct of the creative process itself, but also the development of problem-solving skills.

Iacovides et al., (2014) also examined how motivation and engagement relate to informal learning in the context of commercial digital games. Unlike Voulgari et al.'s (2014) study, participants were not all experienced gamers and played a variety of game genres, providing a more accurate representation of how a range of players may learn from different types of commercial digital games. Through a set of studies combining qualitative interviews, diaries, lab observation sessions and a survey, the authors identified several gaming practices which contributed to different learning outcomes, as described in their Gaming Involvement and Informal Learning (GIIL) framework (Figure 5).

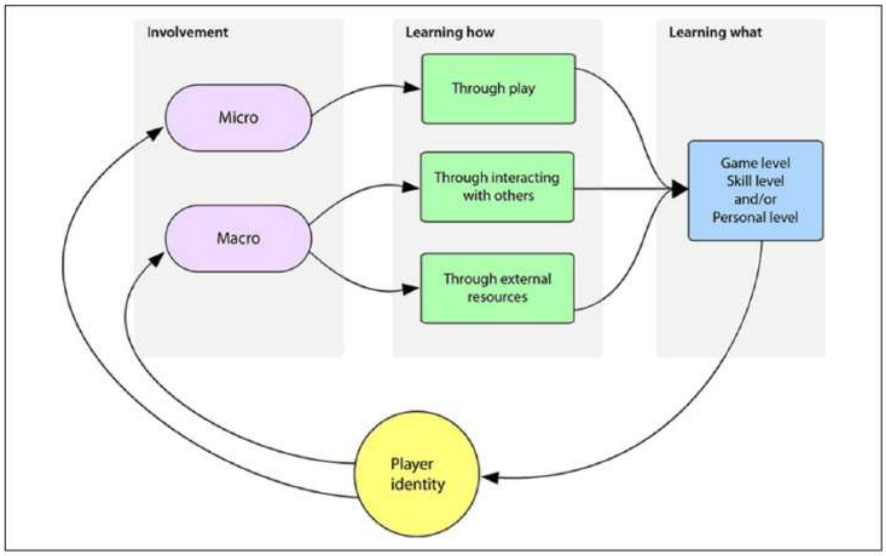



*Figure 5: GIIL Framework (Iacovides et al., 2014, p.11)*

Drawing from Calleja's (2011) Player Involvement Model, they identified three distinct ways of learning arising from micro and macro involvement. Micro level related to directly engaging with the game (e.g. working out controls), while macro level related to engaging with external resources (e.g. discussion forums, tangential resources). By engaging with micro and macro practices, players could learn on three levels. On the game level, players could learn game specific aspects such as controls and strategies. On the skill level players could develop psycho-motor, cognitive, technical, literacy, numeracy and social skills. On the personal level, learning included affective outcomes such as cultural and emotional development as well as general knowledge (Iacovides et al., 2014). In addition, a cyclical relationship was found between player identity, involvement and informal learning. Essentially, the more a player identified as a gamer, the stronger their involvement with the game would be and in turn, the more they were able to

participate in the different gaming practices, and as a result, the more they seemed to learn (Iacovides et al., 2014).

The GIIL framework provides an overview of what learning outcomes can be gained from different learning practices. Like Voulgari et al.'s (2014) framework, the GIIL includes affective outcomes which may point to a relationship with creativity as affective change. However, as this framework was not developed to account for the role of creativity in the learning process, it is difficult to gauge which learning outcomes may relate to different creative expressions. Furthermore, although most participants agreed the learning was positive, not all agreed learning on a game-level was valuable. As such, it is important to consider whether people are *aware* of what they are learning and whether they *value* what is being learnt (Iacovides et al., 2014). This may point to further intricacies in relation to the role of creativity in relation to value.

In conclusion, it has been suggested that players are able to develop a variety of learning outcomes from commercial entertainment games such as language learning (Bytheway, 2015; Chik, 2014), cognitive skills such as problem-solving and planning, social skills, personal development and knowledge acquisition (Iacovides et al., 2014; Voulgari et al., 2014). However, as Iacovides et al. (2011) point, out a better understanding of what occurs during everyday game-play practices is needed to illuminate exactly what players may learn when playing commercial entertainment games. In the case of Voulgari et al.'s (2014) study, participants were experienced players of digital games, and as such, may have had more of an awareness of what they were learning and how to use and adapt the game for their needs, giving rise to the question of whether gameplay experience may impact the likelihood of learning occurring. Finally, while these frameworks provide a basis to categorize the competencies players may develop and provide potential links to some forms of creativity (e.g. affective change), they do not account for the role of creativity, both within the game, and within the learning process. This gives rise to the question of what specific skills can be developed from being creative in games. And how do different forms of creativity contribute to learning?

### 2.3.2 Transferability of Creativity

Just as creativity has been argued to play a core role in the learning process (Ott & Pozzi, 2012; Rogaten & Moneta, 2017; Vygotsky, 2004), it has also been cited as being highly transferrable and relating to a variety of domain unspecific skills such as critical thinking and problem-solving (Carvalho et al., 2015; Mayer, 1989). In addition, it has been argued that we now live in a "creative society" where the ability to think and act creatively is instrumental to success in both work and life (Resnick, 2007).

Some research has been done into the propensity for digital games to aid the development of transferrable skills, which have also been referred to as 21st century skills (Partnership for 21st Century Skills, 2019), knowledge age skills (Clough & Ferguson, 2010) and digital competencies (Kluzer et al., 2018) to name a few. According to Levy and Murnane (2004) the rationale behind the transferrable skills movement is the "growing proportions of the nation's labor force [which] are engaged in jobs that emphasize expert thinking or complex communication tasks that computers cannot do" (Levy & Murnane, 2004, pp. 53–54). For example, competencies such as collaboration, innovation and creativity have been argued to be highly transferrable and domain unspecific (Pellegrino & Hilton, 2012). While conventional instruction focused on the application of pre-digested information to build routine problem-solving skills removed from their application to knowledge, transferrable skill focused education places emphasis on "learning a specific problem-solving routine to match every situation" (Dede, 2009, p. 3).

There have been numerous frameworks which attempt to define transferrable skills. For example the Partnership for 21st Century Learning Framework (P21) was developed by education experts, business leaders and educators to "define and illustrate the skills, knowledge, expertise and support systems that students need to succeed in work, life and citizenship" (Partnership for 21st Century Skills, 2019, p. 1). P21 defines three core sets of skills. Learning innovation skills, known as the "4Cs", comprise of critical thinking, communication, collaboration and creativity. Life and career skills include traits such as flexibility and adaptability as well as initiative, self-direction, leadership and social and cross-cultural skills. Information, media and technology skills include a range of functional and critical thinking skills such as information literacy, media literacy and ICT literacy. Other attempts to define transferrable skills include Trilling and Hood's (2001) "7Cs" which include critical thinking-and-doing, creativity, cross-cultural understanding, learning self-reliance, career, computing and collaboration (Trilling & Hood, 2001), and the European Commission's Digital Competence Framework (DigiComp) (Kluzer et al., 2018) which includes competence areas such as communication and collaboration, problem-solving and digital content creation.

The 21st century skills movement argues that creativity, like other transferrable skills, is not a fixed characteristic and can be developed as students learn to be more creative (Saavedra & Opfer, 2012). Creativity is facilitated by intrinsic motivation, which is fostered by relevance – i.e. if lessons are relevant to the life of a student then there is a greater likelihood that they are intrinsically motivated and will use their newly gained knowledge and skills creatively (Craft, 2005). In this way, digital games are an apt medium in which to study the development of creativity and related transferrable skills as the motivation to play games has been argued to be largely intrinsic, especially in the case of entertainment games where players choose to play

predominantly due to a personal interest in the game and not for external rewards (Herodotou, 2009; Perrotta et al., 2013; Voulgari et al., 2014; Young et al., 2012).

Work which has examined transferrable skills in the context of digital games have largely looked at the development of 21st century skills in educational games (e.g. Romero et al., 2015; Sardone & Devlin-Scherer, 2010). However, some work has examined the propensity of digital games to contribute to the development of transferrable skills. For example, Alonso-Diaz et al. (2019) used an online survey completed by 404 adult respondents to examine if playing digital games developed key transferrable competencies such as communication and technological skills. They found that role-playing games were the most suited to developing key competencies for a globalised society, and the contextualisation and personalisation of these types of games was essential for the development of hard and soft skills. Sourmelis et al. (2017) also examined 21st century skills within MMORPGs using Binkley et al.'s (2012) framework of 21st century skills. Binkley et al's (2012) framework consists of ten skills divided across four dimensions: *ways of thinking* (including creativity, critical thinking and metacognition), *ways of working* (communication and collaboration), *tools for working* (information and ICT literacy) and *living in the world* (including citizenship and social responsibility). Sourmelis et al. (2017) used iterative selection, filtering and classification to analyse literature concerning learning within MMORPGS from 2010 to 2016. They found that the most studied skills in MMORPGs were communication, learning to learn and metacognition, the least studied being creativity and innovation, critical thinking, problem solving, decision making and citizenship.

While Sourmelis et al. (2017) found communication, learning to learn and metacognition to be the most studied skills, the opposite was found by Qian and Clark (2016) who, using a similar method, found that the most widely researched 21st century skills were critical thinking, with communication skills being the least studied. However, the discrepancy in these findings could be explained by the fact that Sourmelis et al. looked specifically at MMORPGS, Qian and Clark looked at multiple types of digital games. While Qian and Clark specify that their review covers a variety of games (serious games, console games, online games, edutainment), most papers they reviewed were concerned with educational games, and hence their findings may be skewed towards games with specific skill development in mind. As such, skills such as critical thinking, problem solving and even creativity could be more easily assessed in a game designed specifically to foster these skills, however, communication and social skills may be far harder to assess in a formal setting than in a more natural milieu such as a MMORPG.

Similar to 21st Century Skills, Barr (2017) examined the propensity for digital entertainment games to develop graduate attributes which are defined as "generic skills such as problem-solving, communication, resourcefulness or adaptability which are considered desirable

in graduates" (Barr, 2017, p. 86). Using a series of scales to measure communication, adaptability and resourcefulness, 100 students were recruited to take part in randomised trials involving control and intervention groups which completed both pre and post-tests. While only 36 participants went through to completion, it was found that commercial games had a positive effect on communication, adaptability and resourcefulness. A follow up qualitative study by Barr (2018) involving lab-based control/intervention groups and interviews with 20 students supported previous results, finding that students did see value in playing digital games and believed that they aided towards the development of graduate skills.

However, in a more recent cross-sectional study of game playing habits and graduate skills involving an online survey completed by 2145 respondents, it was found that there was no strong correlation between game play habits and the development of graduate skills (Barr, 2020). Moreover, it was found those that do not play digital games scored higher on measures of graduate attributes. However, as Barr (2020) notes, while playing games under normal circumstances may not increase graduate skill development per se, the overall picture is more complex and factors such as mode of play (e.g. online, co-op, etc) and varieties of modes may be important determinants in skills development. Furthermore, while skills such as adaptability have been argued to be associated with creativity (e.g. Mumford et al., 1994), there were no measures of creativity included in the survey.

While previous work outlined examines transferrable skills but does not focus exclusively on creativity, Ferguson (2011) examined creativity and meaningful learning in the Schome Park Programme set in the virtual world of Teen Second Life (Linden Labs, 2005). They argue that creativity and meaningful learning are inherently linked, with creativity being facilitated when learning is deemed "meaningful" by connecting information stored in long-term memory with new experiences (Clough & Ferguson, 2010; Grabe & Grabe, 1998). Meaningful learning is "active and constructive, taking place when people develop knowledge in response to their environment, reflecting on activity and articulating what they have learned" (Ferguson, 2011, p. 170). In addition to being situated in a meaningful context by working towards a goal, learning is authentic, intentional and cooperative where learners socially negotiate a shared construction of knowledge (Jonassen et al., 2003). In this way, learners can creatively experiment with and work through ideas and solutions together, reflecting, refining and learning throughout the process.

Ferguson (2011) and Clough and Ferguson (2010) categorised learning outcomes within the project using the Knowledge Age Skills Framework developed by the Schome Park Programme. The framework focuses on transferrable skills which are domain unspecific and includes assessment criteria for skill which demonstrates the development of the skill from levels 1 to 4. Skills include communication, confidence, creativity, leadership, motivation, problem-

solving and teamwork. For example the progression of creativity from level 1 to 4, includes at level 1 the ability to question and challenge, at level 2 the ability to make connections and visualise relationships, at level 3 the ability to envisage what outcome there may be, and at level 4 the ability to reflect critically on ideas and practices (Clough & Ferguson, 2010). The skills are not correlated with specific resources (i.e. creativity is not limited to proficiency in art or music) and instead a more generalised and fluid approach is taken to defining skills.

Ferguson (2011) highlighted the link between a meaningful learning context and the development of creativity. She used a grounded approach to analyse a 120-post forum discussion in which 19 learners and educators from the Schome Park Project debated the development of their virtual environment. It was found that the learners were able to engage in interthinking by blending and reconfiguring ideas while communicating and working on problems collaboratively (Lucas, 2001). The learners effectively shared resources, created and assigned roles for themselves, debated, negotiated and developed a creative vision of their intended project. Other skills they developed included community skills such as membership, trust, trading and creative skills such as art and design (Ferguson, 2011).

The virtual island which the learners inhabited was their own to design and populate how they chose, allowing them to form their own goals and decide how to tackle them. However, the programme was created with the intention to be a "a space in which new forms of distance education practices could be tried out in order to develop visions for the future" (Sheehy et al., 2007, p. 95) and hence, learners who engaged in the project did so with knowledge that is was an educational programme. As such, it is unclear whether the same skills could be developed within digital entertainment games.

In conclusion, there are frameworks which attempt to categorise the transferrable skills required in the new digital age. While frameworks may differ slightly, the core skills remain the same with creativity highlighted as an important skill which can be utilised in multiple situations. Research has demonstrated that commercial entertainment games may facilitate the development of some transferrable skills (e.g. Alonso-Díaz et al., 2019; Sourmelis et al., 2017), and the Schome Park Project (Clough & Ferguson, 2010; Ferguson, 2011) highlights the potential for virtual worlds to be utilised as a means to develop creativity through meaningful learning. However, as Romero et al. (2015) point out, these studies do not tell us how learners then go about utilising the creativity and creative based skills in other areas of life. For example, do players who develop creativity and related skills in digital games use them more in certain areas of their life than others? And, what forms of creativity and related skills are most likely to transfer between games themselves? In addition, it has been suggested that different types of games may

contribute to different transferrable skills (Sawyer & Smith, 2008), and that game characteristics such as affordances may have an impact on creativity (Charsky, 2010; Garris et al., 2002).

## 2.4 Affordances for Creativity

There have been numerous definitions of affordances – from the traditional notion of actionable properties of an environment (Gibson, 1977), to the broader definition of opportunities for action (Cardona-Rivera & Young, 2013), opportunities for a certain behaviour (Kim & Shute, 2015) or "environmental properties that create consequences for individual behaviour" (Alahuhta et al., 2014, p. 3). As such, in the context of this thesis, a wider definition of affordances will be used; namely the opportunities that games provide for creative actions, behaviours or thoughts. In this way, the final section in this literature review will synthesise work on design aspects which provide affordances for player creativity.

The relationship between creativity and affordances has been granted increasing attention, with work examining affordances for creativity in the playground (Withagen & Caljouw, 2017), affordances for creativity in team collaborations (Terrenghi et al., 2006), and affordances for team creativity in virtual worlds (Alahuhta et al., 2014). It has been argued that creativity is not simply an inherent quality that individuals are born with, but instead can be enhanced through interaction with the environment (Amabile, 1996).

As such, affordances have been stressed to play a crucial part in creative behaviour, with Glăveanu (2013) positing a framework of creativity which includes affordances. Glăveanu's (2013) framework, which is based on the P's perspectives of creativity (see section 2.1.1.3), divides the "press" perspective into the components of "audience", relating to the social forms of press, and "affordances" relating to material objects which constrain or allow creative action. Glăveanu's (2013) concept of affordances, based on Gibson's (1977) conceptualisation, states that creative individuals are able to exploit affordances in their surroundings in innovative ways which allow them not only to discover new affordances, but also create affordances to achieve certain actions. In this way, affordances do not relate solely to one specific use, but can realise multiple uses from conventional to highly creative (Glăveanu, 2012). On a similar note, Withagen and van der Kamp (2018) argue that creative individuals are not only able to discover and create new affordances, but also use existing affordances in unconventional ways.

Before examining the various affordances which may facilitate player creativity in digital games, the concept will firstly be located within the wider field of HCI to provide a wider contextual basis. The following section (2.4.2) will move on to examining affordances in relation to digital games, providing a broad overview of the basic types of affordances in gameplay. The next section (2.4.3) will attempt to coalesce some of the current literature which focuses on how creativity can be facilitated by game design. The remaining sections will narrow in on the different components within games which provide opportunities for player creativity, focusing on player

motivation as a key aspect of creativity (2.4.4), game mechanics (2.4.5), narrative (2.4.6) and customisation (2.4.7).

### 2.4.1 Affordances in HCI

While affordances in relation to creativity in digital games has been granted limited focus, the concept is prevalent in the field of HCI, with many differing notions on how affordances are conceptualised. The term was first thought to be coined by the perceptual psychologist Gibson in his Theory of Direct Perception (Gibson, 1977) and referred to the actionable properties of an environment (e.g. what opportunities for action an object encourages). However, various criticisms have been made of Gibson's original theory; most notably relating to the claim that affordances can be directly perceived. Critics argue that the affordances of human artefacts could not be identified by someone who was a complete stranger to them (Costall, 2012). In terms of technology, this is duly evident – unless one is already familiar with similar devices such as game controllers then the actionable properties of such an item will be unidentifiable, or only uncovered by mere chance.

Norman (1988) popularised Gibson's concept of affordances, however, unlike Gibson, who focused on the perceived affordances of an environment, Norman argued that there exists both actual and perceived affordances of objects and that these can be mutually exclusive, i.e. a perceived affordance may not in fact be an actual affordance (Norman, 1988). Where Gibson claimed the existence of affordances is independent of an actor's culture, history and experience, Norman argues that "affordances result from the mental interpretation of things, based on our past knowledge and experiences applied to our perception of the things around us" (Norman, 1988, pp. 219). In this regard, Norman's concept of affordances is more applicable to the HCI perspective in that we are able to identify technological affordances from past experiences with similar technologies which have provided us with the information to identify such possibilities for action. As such, Norman's (1988) concept of affordances may help illuminate the transfer of game specific skills from one game to another – players are able to build up a wealth of experience from interacting with games which then enables them to identify the technological affordances required in other games (i.e. the controls and general mechanics).

Using a mediated action perspective, Kaptelinin and Nardi (2012) argue technology serves as a medium for the individual to interact with the world both directly and indirectly, influenced by factors such as culture, motivation and context. They define two aspects of technology interaction as *handling affordances* (direct, person to technology), i.e. the possibilities for directly interacting with an object, and *effecter affordances* (indirect, technology to object), i.e. the effect

the interaction has on the object. An example of this could be a player using their game controller to navigate through the options in the avatar customisation screen at the start of a game (handling affordance) using it to make changes to the appearance of their avatar (effecter affordance). In this way, the player is interacting directly with the game via the controller and indirectly via the effect of the controller on the in-game options for avatar appearance.

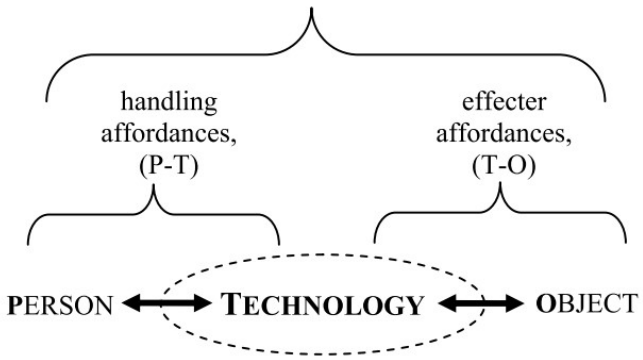



*Figure 6: Two Facets of Instrumental Technology Affordances: Handling and Effecter* (Kaptelinin & Nardi, 2012, p. 972)

Using Kaptelinin and Nardi's (2012) terminology in the context of this thesis, handling affordances would refer to the multitude of ways in which players are able to interact with digital games, such as the specific controls, the availability of branching narratives, or the array of weapons. By providing a greater number of handling affordances, the player is given greater creative scope to combine variables, character moves, and choose the trajectory of the story. Effecter affordances would constitute the effect such actions have on elements of the game world – for example, in the case of branching narratives, choosing one dialogue option would change the course of a particular quest or the main story, providing opportunities for creative engagement with the game narrative.

In addition to handling, effecter and instrumental affordances, the model posits a further three types of affordance. *Maintenance affordances* relate to affordances for the maintenance of the technology at hand (e.g. a wireless gaming controller must allow the player to charge or replace the batteries). *Aggregation affordances* relate to affordances for the combination of the technology with other digital and non-digital artefacts and may help explain some forms of game-related creative appropriation. For example, the German band Pornophonique combine a Commodore 64 and Game Boy with other instruments to create much of their music. Finally, *learning affordances* relate to how a technology guides the user to the appropriate actions (e.g. through use tips or help menus).

Kaptelinin and Nardi (2012) provide a broader concept of affordances in HCI which can be applied to a variety of technologies such as digital games. The core elements of the model such as handling and effecter affordances may provide a macro level view of how players can interact with games, however, as Glăveanu (2013) argues, affordances can realise both simple and highly creative actions. While handling and effecter affordances illustrate what basic actions may be possible, they do not detail the spectrum of creative interaction within such affordances. Aggregation affordances may help shed light on the creative appropriation of games such as the use of games as musical instruments.

In conclusion, Gibon's (1977) initial theory of affordances posited that affordances can be perceived directly in the environment and exist whether or not the user perceives them. In contrast, Norman (1988) argued that perceived and actual affordances can differ from each other and that the goal of HCI should be to design so that affordances are perceived accurately (Norman, 1988). This may help illuminate how different players perceive affordances in games depending on variety of factors such as past gaming experience or familiarity with a specific genre. Finally, Kaptelinin and Nardi (2012) posited an alternative to Gibson's (1977) ecological psychology, adopting a mediated action perspective in which technology serves as a medium in which individuals interact with objects. Kaptelinin and Nardi's (2012) perspective illustrates two basic types of interaction with games (through handling the technology directly via a controller, and indirectly through the effect the handling has on the game), however, it does not account for the spectrum of creative interaction with these affordances.

### 2.4.2 Affordances in Digital Games

While theories on affordances such as Kaptelinin and Nardi's (2012) mediated action perspective may serve as a general top-down guide for studying affordances in games, there remains a limited amount of literature which specifically examines affordances within the context of digital games.

Cardona-Rivera and Young (2013) argue there are two angles from which affordances in digital games have been examined. The first is from Norman's (1988) perspective which argues that by allowing players agency through interactive game narrative, a feeling of empowerment will follow as the actions a player takes relates to their intentions (Mateas, 2003). According to Mateas (2003), games and interactive narratives constitute two different kinds of affordances. The first type of affordance according to Mateas (2003) are *material affordances* which refer to opportunities for action in a game which are presented to the player. These can be presented directly through in-game prompts or indirectly by simply not prohibiting the actions of the player.

The second type of affordances according to Mateas (2003) are *formal affordances* which suggest the correct action to be performed.

In contrast, Linderoth (2010, 2011) adopted Gibson's (1977) ecological approach and argued that games do not serve well as learning environments. This is because games can encode and facilitate *exploratory* actions (actions which provide knowledge about affordances) and *performatory* actions (actions which then realise the affordances) that allow game progression to be effectively "built-in". In this way players solely respond to affordances, without understanding the specific information relating to objects outside the gaming domain – for example, the herbalism skill in some games requires players to collect different types of plants, however, the plants are identified solely by their colour in the game and use in the creation of potions, and not in regards to their application in the real-world. However, while Linderoth fails to recognise the role of cognition in his theory of affordances, it has been argued that some learning must occur in games to link the cognitive processes associated with understanding (e.g. the mechanics of the game), comprehension (e.g. engaging and following the game narrative) and retrieval of prior knowledge (e.g. using strategies from similar games) (Cardona-Rivera & Young, 2013; Shuell, 1986).

In order to take into account the cognitive processes involved in gameplay Cardona-Rivera and Young (2013) posited a cognitive theory of affordances for games which argues that game designers should primarily focus on perceived affordances (i.e. what players think they can do) over actual affordances. They identified three types of affordances in game design: *real affordances* which relate to actual affordances for action in game, *perceived affordances* which relate to what players perceive is possible. Perceived affordances may not correspond to real affordances, but instead the "the perceived course of action must conform to what a player believes is possible and must be consistent for the player within the game's context" (Cardona-Rivera & Young, 2013, p. 4). Cardona-Rivera and Young (2013) argue perceived affordances can be informed by previous gaming experience (memory and analogical thinking skills) in addition to direct experiences in the game (perception and attention). Finally, *feedback affordances* relate to perceptual information which is targeted at promoting real affordances in the hopes of accurately guiding the player's perceived affordances.

In essence, factors such as player experience, history and personal beliefs play a crucial role in the perception and realisation of affordances in digital games. In this way, how a player perceives an affordance may be a more accurate measure of the possibilities of play, however, there are problems in terms of guiding players to perceive such affordances accurately. For example, the notion of perceived affordances may have issues when applied to aspects of creativity such as appropriation which can include using game mechanics for means other than

intended. In this case, such unintended uses could be argued to be actual affordances of game mechanics, and their corresponding perceived affordances are hence not guided by the developers.

In conclusion, Linderoth (2010, 2011) argues that game progression is effectively built into the game with players simply responding to exploratory and performatory actions. However, Mateas (2003) and Cardona-Rivera and Young (2013) argue that there are a variety of cognitive elements at play such as a player's past gaming experience, and that these cognitive elements contribute to how affordances are perceived within the game. By providing a general view of the main types of affordances in games, the affordances which contribute to player creativity may be explained. However, while illuminating how design elements can accommodate different affordances, insight is not provided into what forms of creativity such affordances facilitate.

### 2.4.3 Game Design for Creativity

While theories on affordances such as Kaptelinin and Nardi's (2012) mediated action perspective may serve as a general top-down guide for studying affordances in games, there remains a significant gap in the literature in relation to how games can be designed to facilitate creative behaviour.

Unlike traditional media, digital games afford players a higher level of interactivity where they can manipulate both the form of the game such as design elements and the content such as the storyline and meaning (Grodal, 2000; Weber et al., 2014). Games can allow those who play them to unleash their imagination through providing a *possibility space* which starts at a well-defined state and then allows the player to reach the end of that state in any way they choose. In this way, the possibility space is navigated through constant choices and actions (Wright, 2006). According to Järvinen (2008) if the possibility space is limited in terms of choices and actions then the progression in a player's abilities and strategies will be hindered. The larger the possibility space, such as providing alternative mechanics or routes of play, then more unique strategies will be created and players will able to develop their creative abilities (Järvinen, 2008).

On a similar note, Gee (2005) argues that good game design facilitates player creativity by firstly providing players with the agency to make their own choices and choose their own actions. In this way, the set of actions and choices a player makes is in itself an act of production which extends not just from the in-games choices and actions, but also includes acts of creation such as making maps using level editors. Secondly, a well-designed game encourages risk taking, exploration, learning from failure and trying new things. Risk taking has been associated with the creative characteristics of being open to change and generating new ideas (Madjar et al., 2011)

and willingness to take risks when there is a possibility of failure has been identified as an essential creative trait (Csikszentmihalyi, 1996; Sternberg & Lubart, 1996). Games present a range of difficulty levels which provide the player with a challenge, allow them to learn from their mistakes and provide a sense of accomplishment once completed (Gee, 2005).

While it has been suggested that opportunities for risk taking, exploration, discovery and challenge facilitate player creativity, there is still little work which has been conducted in relation to how particular design affordances relate to different aspects of creativity. For example, Kim and Shute (2015) highlight that studies which have looked at the relationship between digital games and creativity have viewed creativity as a "unidimensional cognitive ability by using existing creativity tests that depend heavily on divergent thinking" and have not examined how different aspects of creativity can be designed for in games (Kim & Shute, 2015, p. 102). Using the four C model of creativity (Kaufman & Beghetto, 2009) and Gee's (Gee, 2003b, 2008) differentiation between the semiotic domains of *Little G* (a game as software) and *Big G* (social interactions outside of the game), Kim and Shute (2015) proposed a two dimensional approach to the study of affordances for creativity in games (see figure 7).

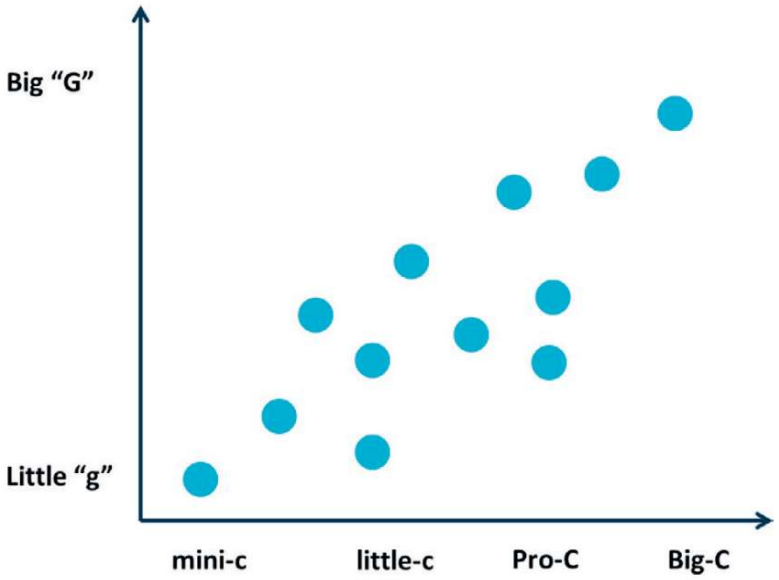



*Figure 7: Two-dimensional approach to creativity in digital games* (Kim & Shute, 2015, p. 105)

Kim and Shute argue that not all games afford opportunities for Big G creativity and instead most games fall near the Little G level, such as *Candy Crush Saga* (King, 2012) where opportunities for Mini C or Little C creativity can only be realised within a particular context (i.e. the problem-solving required to progress in a particular level). However, some games operate at both the levels of Little G and Big G, where several modes of play are presented to players. Kim

and Shute provide the example of *Little Big Planet* (Media Molecule, 2008) which affords the player different levels of creativity within the different modes (play, share or create). The game encourages the creation and use of user-created content through earning extra items in the play mode which can then be used in the create mode later and subsequently can be shared with other players. When a player initially begins the game they can progress by using fairly typical solutions but later come up with their own ideas and interpretations of the challenges (Mini C in the Little G category). As the player becomes more familiar with the game they can take screenshots of their creative solutions and share them with the online community (Little C in the Big G category). Finally, after a significant amount of time engaging in the online community, the player is able to develop advanced user-created content skills and become recognised within the community (Pro C in the Big G category) (Kim & Shute, 2015).

Kim and Shute's (2015) two-dimensional approach to creativity in games provides a method for assessing a game's capability to cater for the different levels of creativity, from allowing players to create and devise their own strategies, to creating their own content and finally to sharing this content within the wider semiotic domain. However, the approach is limiting in terms of what affordances relate to certain levels (e.g. the affordances for content creation relate to pro-c and big-c levels). The Pro C/Big G level appears to only be attainable when a player actually creates game content and is then recognised by the gaming community. However, in the case of many MMORPGs in which developers introduce updates, players or teams of players may work co-creatively to discover an optimal strategy to beat the end boss. In this case the player has not created anything in terms of game content, but instead discovered a novel strategy. Additionally, what about the case of instances where gameplay is appropriated such as speedrunning where a player discovers the fastest route through a game? In both examples, players could become well known within the gaming community, however, in the first the player has not created any game content, and in the second, the player has devised a new way of playing the game entirely. As such, the question is posed as to what level of creativity these acts would fall under.

In conclusion, work which has examined affordances for creativity remains sparse. Games provide players with a possibility space which they navigate through a continuous array of choices and actions, with the larger the possibility space, the more creative potential the game has for players (Gee, 2005; Järvinen, 2008). Games which facilitate risk taking and promote learning from failure enable players to discover novel strategies and ways of play (Gee, 2005). Kim and Shute (2015) identified key elements of games which afford different levels of creativity from Mini C through to Big C within the semiotic domains of Little G and Big G. While work has identified some key affordances such as customisation and provisions for content creation, there is still little in the

way which links other elements of game design to different forms of creativity, such as appropriation.

### 2.4.4 Player Motivation

While not an affordance for creativity per se, intrinsic motivation has been argued to be a key component of creative behaviour (Amabile, 1990; Craft, 2005; Stohs, 1992). As such, designing games with intrinsic motivation in mind may provide an apt environment for player creativity. Motivational affordances (Zhang, 2008) have been explored with regards to self-determination theory (SDT) (Deci & Ryan, 1985; Ryan & Deci, 2000) and need satisfaction theories which argue that humans seek out and engage with activities which satisfy motivational needs including competence (desire to feel effective), relatedness (desire to feel connected to others) and autonomy (desire to self-initiate and self-regulate own behaviour) (Economides & Perifanou, 2018). In this way, digital games afford "motivation…when the relation between the features of an object and the abilities of a subject allow the subject to experience the satisfaction of such needs when interacting with it" (Deterding, 2011, p. 2). In this way, digital games can afford opportunities to fulfil motivational needs such as providing optimal challenges to fulfil competence and catering for autonomy by providing a large possibility space (Järvinen, 2008) for players to find their own route through the game.

Design considerations for player motivation have been explored in research by Bowman (1982), Rieber (1996) and Malone (1981), which demonstrated that core elements of game design include clear tasks and goals, feedback and incrementally increasing challenges. These aspects are in line with Csikzsentmihalyi's (1990) flow theory which outlines six precursors to the flow state including clear and precise feedback, skill/challenge balance and autotelic experience. While SDT (Deci & Ryan, 1985; Ryan & Deci, 2000) has been used in relation to motivational affordances (e.g. Deterding, 2011; Economides & Perifanou, 2018; Songer & Miyata, 2014), flow theory has been given attention in terms of the elements of game design which foster flow. For instance, the GameFlow model by Sweetser and Wyeth (2005) attempts to draw a direct link between game design elements and flow. Table 1 outlines some examples of flow related game design elements:

| Game Design Element | Description |
|---|---|
| Concentration | Game provides stimulus from many different sources and which grab and maintain attention (Lazzaro, 2004; Pagulayan et al., 2003). Irrelevant tasks are kept to a minimum to avoid distraction. The game needs to have a high workload to take up attentional resources, however, it needs to be balanced with the limits of player's abilities. |
| Challenge | Challenges need to match player skill level, while still providing different levels of challenge for different players (Lazzaro, 2004). Challenge should scale with skill as the player develops their abilities (Desurvire et al., 2004; Pagulayan et al., 2003). Challenges need to be introduced at an appropriate pace (Federoff, 2002). |
| Player Skills | Games should be intuitive and learning the game needs to be a pleasurable experience through initial tutorial game levels and hints (Federoff, 2002). Player skill should increase appropriately as they progress through the game and as such should be rewarded. Game interfaces and mechanics need to be easy to use as to not obstruct gameplay. |
| Control | Players should feel a high level of control over their avatar's movement and interactions, the interface, game controls and the stopping, starting and saving of their game. The impact of their play should be observed in the game world. Additionally, players should feel control over their actions and have a sense of freedom. |
| Clear Goals | The game should introduce clear goals early and intermediate goals need to be appropriately paced. |
| Feedback | Player should receive feedback on their goal progress, their actions and should always be able to know their status or score. |
| Immersion | Players should become less aware of their surroundings, their self-awareness and their worries. They should experience temporal distortion and feel emotionally and viscerally involved in the game. |
| Social Interaction | Competition and cooperation between players should be supported as well as opportunities for social interaction and the formulation of social communities both inside and outside the game. |

*Table 1: GameFlow Model Elements*

It has been suggested that there is a link between flow and creativity, with flow acting as a facilitator for creative behaviour (Cseh et al., 2015; Csikszentmihalyi, 1996; MacDonald et al., 2006; Sorensen, 2007). This could be due to flow experiences being intrinsically motivating – something which also plays a key role in creativity (Amabile, 1990; Craft, 2005; Stohs, 1992). As Hamlen and Blumberg (2015) argue, digital games which facilitate intrinsic motivation through interest, challenges and/or entertainment provide an apt medium to engage creative thinking. As such, designing games which promote flow in players could be considered as an indirect way of facilitating creativity. However, while models such as the GameFlow model highlight the importance of designing for player motivation, they tell us more about the outcomes of good game design, rather than the design elements themselves. For example, they do not tell us about

how such elements are then realised in the game's structure, i.e. how feedback is integrated into the game.

### 2.4.5 Game Mechanics

Another component which may offer opportunities for player creativity are game mechanics. Over the years there have been a number of definitions of game mechanics used in contexts such as game design (Hunicke et al., 2004) and analysis (Järvinen, 2008). Some approaches make the distinction between the rules of the game and the actions afforded to players by those rules. However, it has been argued there should not be a dichotomy between rules and game mechanics and that the term game mechanics should encompass rules which are applied through interaction with the game (Lundgren & Björk, 2003). In this way, mechanics can afford various types of interaction with elements of the game – such as items (e.g. a sword may afford slashing), abilities (e.g. a shaded area may afford stealth) and different forms of movement (e.g. a lake may afford swimming). In this way game mechanics refer to the "various actions, behaviours and control mechanisms afforded to the player" (Hunicke et al., 2004, p.3). While mechanics can present a variety of developer intended affordances, as Glăveanu (2013) and Withagen and van der Kamp (2018) argue, creative individuals not only able to discover new affordances, but also identify unconventional uses for affordances. This could help illuminate forms of creativity such as appropriation where players use game mechanics in unintended ways – such as transgressive forms of play (Aarseth, 2007).

One framework which provides a detailed description of how game mechanics and aesthetic elements provide a unique experience is the Mechanics, Dynamics and Aesthetics (MDA) framework by Hunicke et al. (2004) (figure 8) who argue that games are akin to artifacts rather than media as "the content of a game is its *behaviour* [and] not the media that streams out of it towards the player" (Hunicke et al., 2004, pp.2). Games can be viewed as systems which build behaviour through interactions with three distinct components: rules, system and "fun", each with their own design counterparts.

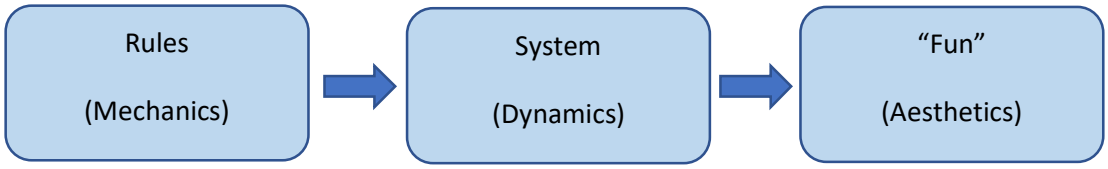



*Figure 8: MDA Framework* (Hunicke et al., 2004, p. 2)

The design of game aesthetics contribute to what makes a game "fun". When referring to fun, Hunicke et al. makes it clear that while many games are intrinsically fun, it is more "informative to consider the aesthetic components that creates their respective player experiences" (Hunicke et al., 2004, p. 2).The MDA lists a non-exhaustive taxonomy of the different aesthetic goals in games (see table 2), although it is worth noting that one game may incorporate many different types of aesthetics, for example, *The Sims* (Maxis & The Sims Studio, 2000) includes the aesthetics of discovery, fantasy, expression and narrative.

| **Aesthetic Goal** | **Description** |
|---|---|
| Sensation | Game as sense-pleasure |
| Fantasy | Game as make-believe |
| Narrative | Game as drama |
| Challenge | Game as obstacle course |
| Fellowship | Game as social framework |
| Discovery | Game as uncharted territory |
| Expression | Game as self-discovery |
| Submission | Game as pastime |

*Table 2: Taxonomy of Aesthetic Goals* (Hunicke et al., 2004)

A taxonomy such as this not only provides a basis on which to describe, study and design games, but also illuminates how games can cater for many different types of players, or to the same players but at different points of their gaming experience.

Aesthetics are realised by gameplay dynamics which describe how each aesthetic element is created – for example the aesthetic of fellowship can be created using gameplay dynamics such as encouraging sharing information with other players or adding winning conditions which are harder to achieve through solo play. Dynamics are optimised to support the aesthetic goal of the game, for example, a game such as *Life is Strange* (DONTNOD Entertainment, 2015) would have dynamics to support the narrative aesthetic such as encouraging players to pick different dialogue options, and to explore the different ways the narrative can play out, hence providing opportunities for creativity in terms of affective change.

Game dynamics are supported by game mechanics which include the tools at the player's disposal such as weapons and actions. Mechanics can give rise to different gameplay dynamics

depending on the type of game, for example an online shooter game which affords players different spawn points, weapons and types of ammunition may give rise to dynamics such as sniping or "camping" other players (waiting at their spawn location to kill them).

While the MDA accounts for the interplay between different design elements and the aesthetic goals of a game, it does not take into account player agency or the context in which mechanics are used within the game. According to Järvinen (2008), game mechanics define the scope of player agency by guiding the player into certain behaviours through constraining the possibilities of play available. Similarly, Sicart (2008) maintains there is a distinction between rules and mechanics, with mechanics referring to the player's interaction with the game and rules referring to the "possibility space where [the] interaction is possible, regulating, as well the transition between the two states" (Sicart, 2008, p. 6). Sicart further argues that the context of the player presence within the game plays a role in triggering game mechanics, something which he defines as "context mechanics" (Sicart, 2008, p. 6). For example, the climb mechanic in *Nier: Automata* (PlatinumGames, 2017) requires both specific input from the player as well as proximity to a ladder. In this way contextual mechanics give an insight into how the player perceives objects in the game world, and how objects in the game world are able to portray their intended uses.

### 2.4.6 Narrative

Another game component which may include opportunities for player creativity is game narrative. Narrative in games has been argued to play a major role in player experience. For example, Cole et al. (2015), found that regardless of the game genre, the story in a game was clearly important to players even if it was not highlighted as a primary feature of the game experience. Calleja (2011) makes the distinction between the *scripted narrative* of a game (i.e. the narrative scripted into the game) and a player's *alterbiography* (the narrative which the player creates from their ongoing interaction with the game).

Looking at game narrative from a scripted perspective, many games now allow players to choose from a wide array of dialogue choices which often lead to diverging storylines and multiple endings. This provides opportunities for narrative exploration (e.g. exploring different outcomes of the narrative) and may play a role in providing opportunities for creativity as affective change. In the case of MMORPGs, Dickey (2007, p. 259) argues there "is not a single storyline for players to uncover, but rather the gameplay experience is an environment. Embedded in the environment are thousands of short narrative storylines". The narrative design of MMORPGs is a design model which fosters explorations, with players constantly exploring new regions to uncover new quests, objects and characters.

Although Dickey focuses on MMORPGs, it is now becoming increasingly common in newer single player games to offer players an "open-world" experience where they do not necessarily have to follow the main storyline but are able to diverge and pursue a multitude of side quests each with its own storyline and characters. Providing affordances in terms of narrative choice allows players to pursue different interactions – both with the game narrative and, in online games, with other players. In games such as these, the gameplay is not solely focused on following one single narrative, but instead the game environment can be seen as a network of different narrative spaces for players to engage and interact with (Jenkins, 2004). Each narrative space may require different actions from the player (Dickey, 2007), for example a *collection quest* may require the player to scout the environment to locate certain objects, while an *escort quest* may require the player to ensure the safety of a non-playable character on their journey to a destination. As motivation is a key aspect of creativity (Cseh et al., 2015; Csikszentmihalyi, 1996; MacDonald et al., 2006; Sorensen, 2007), providing players with a diverse choice of different narratives allows different player motivations to be catered for, and subsequently may help facilitate creative behaviour.

Young and Cardona-Rivera (2011) argue that the majority of work on interactive narratives has focused on game actions in relation to internally coherent narratives (i.e. well-structured narratives). They created a model of game story comprehension through narrative affordances that takes into account both the internal structure of the narrative as well as external factors such as the player's cognitive state. As such, narrative affordances are not used in the context of objects which require action like traditional theories of affordances, but instead in the case of story events which "prompt mental structures that allow players to envision intuitive outcomes to the current story" (Young & Cardona-Rivera, 2011, p. 126). Essentially, a narrative affordance constitutes a course of action only when a player can envisage the action in relation to the game's narrative. In this way, narrative affordances may play an important part in creativity as affective change, where players can reflect on the outcomes of their actions in relation to the game narrative (e.g. choosing one dialogue choice over another or siding with one particular faction/group).

Young and Cardona-Rivera (2011) examine narrative affordances in relation to courses of action in the game's scripted narrative, however, they leave out other aspects of the game which may be central to a player's alterbiography. Aspects such as customisation of characters through choosing outfits, looks and even playable character personalities may have a dramatic effect on the narrative experience.

In conclusion, narrative plays an important part of the gaming experience and includes a variety of complex affordances which go beyond the traditional notion of actional objects. Young

and Cardona-Rivera (2011) define a narrative affordance as a course of action available only when a player can envisage the game story. In this way a narrative affordance takes into account a player's cognitive state and engagement with the scripted narrative of the game. However, as Calleja (2011) notes, game narrative is highly complex and also includes a player's alterbiography, or personal narrative which they construct during the course of gameplay. Dicky (2007) points to affordances in relation to diverging narratives, sidequests, and a game's propensity to allow players to customise their avatar as contributing to the personal narrative experience. However, little is still known about how affordances in narrative directly relate to the creative expressions of players – for instance, how does the formulation of a personal narrative relate to the categories of creativity outlined in section 2.1.2? Moreover, not all games are the same in terms of their narrative structure, and as such, it is worth looking into how differing narrative structures influence player creativity.

### 2.4.7 Customisation

Just as options for diverging narratives and narrative exploration provide opportunities for player creativity, the propensity of digital games to allow many aspects of play to be customised also provide a medium in which creativity can be expressed.

Unlike traditional media, the interactive nature of digital games allows players to manipulate both the content of the game (e.g. the narrative, messages) in addition to the form of the game (e.g. design elements and style). Modern definitions of interactivity incorporate the customisation aspect inherent in games. As such video game interactivity (VGI) can be defined as "the possibility for users to manipulate the content and form of communication and/or the possibility of information exchange processes between users or between users and a medium" (Weber et al., 2014, p. 7). Weber et al. (2014) make the distinction between customisation and co-creation where the former relates to the use of game settings to alter existing objects and characters, and the latter relates to instances when new content is created by players through tools such as game engines and level editors. However, rather than a dichotomy between customisation and co-creation, Behr et al. (2016) argue that there is a customisation/co-creation continuum "ranging from simple in-game options to complex modification scenarios" (Behr et al., 2016, p. 289). Behr et al. (2016) argue that even on the low end of the continuum there are opportunities for players to be creative in how they use game settings such as in the FPS game *Counter-Strike* where players change their graphic settings to low to compensate for slow internet connections – something which is not intended by developers but nevertheless is a creative solution to a common problem.

While there are many areas of customisation and co-creation, one area where players can easily express their creativity is in terms of avatar customisation. In general players prefer playing with a customisable avatar, with players rating games with a greater number of customisation options for appearance, abilities, performance, accessories and equipment as being more interactive (Weber et al., 2014). According to Behr et al. (2016) "players not only enjoy the opportunity to customize their avatars, but also players use customization features to creatively tune their character based on momentary game demands" (Behr et al., 2016, p. 291). Similarly, Ward (2015), using Kaufman and Beghetto's (2009) notion of Mini C, argued that the initial creation and further alterations to an avatar's appearance may play an important role in how creativity is expressed by players. He argues that first time players of MMORPGs "can exhibit a nascent or inchoate form of creativity that does not require a tangible product that qualified others would judge to be creative. It merely requires the operation of normal human tendency to create interpretation of experience" (Ward, 2015, p. 123). Hence, affordances for avatar customisation facilitate Mini C creativity by allowing players to construct avatars which reflect their personal understandings of their role and intent within the game. In addition, affordances for customisation promote experimentation by allowing other aspects of the self to be tried out which would otherwise never have been realised.

Similarly, Dickey (2007) argues that affordances in terms of character customisation have significant impact on player motivation and gameplay experience. While focusing on MMORPGs, Dickey argues that the "individual combination of attributes, adornments, skills and traits are what make each character unique" (Dickey, 2007, p.257). At game onset, players are presented with a selection of base-character models which they can then customise with a limited selection of physical traits and attributes which throughout the game they can add to and alter through engaging in the narrative environment. Furthermore, opportunities to customise avatar appearance throughout the game (as opposed to solely at the start) allow the game to be momentarily adjusted to "suit individual needs [and] allow players to creatively alter the video game experience" (Behr et al., 2016, p. 292).

Similarly, Alahuhta et al. (2014), who conducted a systemic literature review of affordances for team creativity in virtual worlds, identified avatar customisation as a key facilitator for player creativity. By being able to customise their avatars, players are not only able to express their individuality, but also construct creative ways to communicate using verbal and non-verbal information. Such information could be in relation to a variety of emotes, voices, as well as what items of clothing are available to wear.

While granting affordances in terms of character customisation is a long established tradition in MMORPGs, it is also common in many single player RPG games such as *The Elder*

*Scrolls V: Skyrim* (Bethesda Game Studios, 2011) and *Dragon Age* series (Bioware, 2009, 2011, 2014). Previous work has suggested that players often strive for identification with their avatars in terms of gender (Behr et al., 2016) and prefer to play avatars similar to themselves (Hsu et al., 2007, 2005; Ogletree & Drake, 2007; Trepte et al., 2011). On the other hand, while such customisation allows players to create avatars which they can identify with, it also allows players to experiment with alternative personas and gain insights into what is it like to play as different people (Lee & Hoadley, 2007; Oliver & Carr, 2009; Ward, 2015). Furthermore, affordances in character development play a crucial role in fostering intrinsic motivation and through the course of gameplay with players often feeling emotional proximity towards the characters which they have spent so long developing (Dickey, 2007).

Ward (2015) also highlights the importance of environmental customisation as an additional affordance for Mini C creativity. This includes objects which can be purchased and displayed such as artwork, plants and furniture as well as allowing players to use a variety of textures. According to Ward, the way a player may personalise their environment is a reflection of their personal creativity which may be synonymous with how they personalise their real-life living spaces (Ward, 2015). Similarly, on the higher end of the customisation/co-creation continuum Behr et al. (2016) point to the ability to create entirely new environments using development tools (e.g. level editors) or creating modifications from scratch by altering the code of a game. In this way "customizing content uses affordances embedded within a game, whereas modifications are technical alterations to the affordances of a game" (Behr et al., 2016, p. 292).

In essence, affordances for customisation in digital games can include a variety of complex scenarios including altering built-in settings, altering avatar appearance and abilities, creating new objects and environments, and creating and implementing modifications. The customisation/co-creation continuum proposed by Behr et al. (2016) accounts for creativity on the low end of the range such as creatively using game settings, to creativity on the high end such as creating entirely new game modifications. Ward (2015) argues that customisation in terms of avatar appearance and environment present opportunities for Mini C creativity in terms of unique interpretations of experiences and reflections on real-life living spaces. Finally, Dickey (2007) highlights the importance of avatar customisation on intrinsic motivation by allowing players to feel a close proximity to their avatars throughout the course of gameplay.

## 2.5 Research Questions

This chapter sought to give an overview of the constructs under investigation in this thesis. Section 2.2 covered creativity and provided an overview of the different conceptualisations while attempting to locate them within the field of digital games. Creativity has been argued to constitute the creation of something novel and useful (Amabile, 1996). However, the reality is that what is deemed a creative act is far more complex and involves the integration and intersection a variety of different factors such as personal traits and experiences, cognitive processes and environmental components.

The overall aim of this thesis is to provide a holistic account of player creativity within digital entertainment games. Digital games have been argued to be highly creative mediums (Jackson, 2012; Jackson & Games, 2015; Jackson et al., 2012). While there is a significant lack of literature which solely examines creativity in digital games, three distinct areas were highlighted from existing work. Creativity as problem-solving relates to the experiential and discovery learning which takes place through ill-structured problems, creativity as appropriation includes the unique and unintended ways games can be played as well as the creation of game content, and finally, creativity as affective change relates heavily to the concept of Mini C (Kaufman & Beghetto, 2009), which included the unique and meaningful interpretations of a game and its narrative. However, there is much to be explored in terms of how creativity is expressed in games, and how this expression alters depending on the type of game. Moreover, while some literature has examined aspects such as problem-solving, appropriation and affective change, there has been no investigation of how players themselves view and define creative behaviour in the game. Thus, the first research question which this thesis will attempt to answer has two parts:

*RQ1 a: How is creativity expressed within digital entertainment games?*

*RQ1 b: How do players themselves conceptualise creativity within digital entertainment games?*

By examining the different ways in which creativity is expressed by players of digital entertainment games this thesis aims to uncover a valuable aspect of the player experience. Through understanding how different game genres contribute to the different forms of creativity it may further enlighten us as to how games can be used to promote creative behaviour, not just from an entertainment perspective but also in other domains such as education.

The second section examined current literature on informal learning in digital games and the transferrable nature of creativity. Creativity has been argued to play an important part in learning (e.g. Ott & Pozzi, 2012; Rogaten & Moneta, 2017; Vygotsky, 2004), with games being argued to provide opportunities for creative behavior and the development of related skills (Boyle et al., 2011; Gee, 2005; Lu, 2013; Van Eck, 2006). The learning which occurs in such games is

largely driven the active construction of knowledge through experimentation, reflectivity and active learning. As entertainment games rarely have learning goals built in, learning is usually informal and can be a by-product of being creative. Models such as Voulgari et al.'s (2014) framework for exploration of learning outcomes and process in MMOGs and Iacovides et al.'s (2014) GIIL framework help to illuminate both how and what players may learn from digital games. However, there remains a significant gap in the literature which looks specifically at what players may learn from being creative. While creativity has not been extensively examined in entertainment games (Qian & Clark, 2016; Sourmelis et al., 2017), work on transferrable learning outcomes such as 21st century skills may help illuminate how games can aid the transfer of creative skills, however, again, there remains considerable questions in relation to where players may use the creative skills developed in games, and what forms of creativity are most transferrable. As such, the second research question which this thesis will attempt to answer is:

*RQ2 a: What do players learn from engaging in creative practices in digital entertainment games?*

*RQ2 b: What aspects of game-based creativity are transferrable between games and real-life?*

Creativity has been granted little focus, and this thesis hopes to provide the initial groundwork for future studies which aim to examine the development of creativity through digital games. Creativity has been argued to be comprised of a variety of different skills and by drawing a link between the different forms of creative expression in games and what players may learn from these instances could help inform us about how players learn from creativity. Moreover, by examining where and how players then use these creative skills, a greater understanding on how creativity can flow between the game and real life will be gained.

The third section focused on affordances for player creativity in digital games. Affordances have been stressed to play a crucial part in creative behaviour (Glăveanu, 2013; Withagen & van der Kamp, 2018), with interaction with the environment being argued to enhance creativity (Amabile, 1996). The concept of affordances was located in the wider field of HCI, covering Kaptelinin and Nardi's (2012) mediated action perspective which provides a macro level view of how players can interact with games. Affordances were then considered in relation to digital games, paying particular attention to Linderoth's (2013) ecological approach and Cardona-Rivera and Young's (2013) cognitive approach. Section 2.4.3 attempted to illustrate how games could be designed with creativity in mind, considering work by Järvinen (2008) and Gee (2005) on possibility spaces as well as Kim and Shute (2015) who attempted to link design affordances to the Four C model of creativity (Kaufman & Beghetto, 2009). However, Kim and Shute's (2015) model is problematic as it assumes a fairly rigid progression of the different levels of creativity and does not account for other forms of creative expression within different types of games. Other game

elements which presented opportunities for player creativity were examined including mechanics (Hunicke et al., 2004), narrative (Calleja, 2011; Young & Cardona-Rivera, 2011) and customisation (Behr et al., 2016; Dickey, 2007; Ward, 2015). While it may seem evident that affordances for a variety of game mechanics, customisation options and narrative exploration present opportunities for creative behaviour, there is still no literature to the author's knowledge which explicitly links aspects of game design to different forms of creative expression. As such, the final research question this thesis will attempt to answer is:

*RQ3 a: What specific game design affordances contribute to player creativity?*

The final research question will explicate the specific affordances which contribute to player creativity and help to establish a link between such affordances and forms of creative expression. By illuminating this understudied area, the final contribution of this thesis will be to the field of game design. If we can understand what mechanisms support or inhibit creativity in digital games, then both commercial and educational games can be actively designed with creativity in mind.

# 3. Methodology

This chapter will cover the methods used in this project. Section 3.1 will provide an overview and justification of the pragmatic research paradigm adopted. Section 3.2 will outline the overall research design by highlighting how the research questions are addressed by each of the three phases. Section 3.3 will describe and justify the adult gamer population chosen for this project. Sections 3.4, 3.5 and 3.6 will cover each of the three phases and are split into sections addressing instruments of data collection and data analysis. Finally, section 3.7 will present the ethical considerations for this project.

## 3.1 Research Paradigm

A pragmatic paradigm will be adopted as this research will be utilising both qualitative and quantitative data. Pragmatism argues that while there is an external world independent of the mind, the world is interpreted subjectively by individuals. As such, pragmatism is not confined by the duality of positivism or constructivism and promotes the use of all appropriate approaches available to address and understand the research issue (Creswell, 2013).

Pragmatism is not assigned to any specific theoretical viewpoint, methodology or procedure and hence fits appropriately to the research issues under investigation (Creswell, 2013). The study of creativity has been investigated across numerous disciplines and using various different methodologies. For instance, creativity has been investigated from the standpoint of cognitive psychology, educational psychology and musical psychology. In contrast to creativity being viewed from the standpoint of different psychological domains, the current research is focused on these constructs within the context of digital games. As such, the newer movement of game studies, and related fields in game design and human-computer interaction are also taken into account.

Due to the diversity of theoretical perspectives and in line with the pragmatist approach, the research will incorporate various strategies of inquiry. In previous studies concerned with the main constructs under investigation (creativity and informal learning), a multitude of different qualitative and quantitative approaches have been used. With respect to the research proposed, the investigation of creativity calls for an exploratory qualitative approach due to significant lack of literature concerning its occurrence within digital games. Informal learning has been investigated within digital entertainment games and several frameworks have been developed.

## 3.2 Research Design

The research questions outline two main areas of focus: creativity and learning. The methods chosen to investigate these areas have been derived from previous studies that have examined similar issues, as well as fit and appropriateness to the research questions. Due to the interdisciplinary nature of the research, a wide variety of strategies of inquiry have been used to address each construct. For example, creativity in games has been investigated with a variety of quantitative scales and self-report measures (e.g. Blanco-Herrera et al., 2019; Moffat et al., 2017), as well as more exploratory measures such as ethnographic methods (e.g. Jarrett, 2014, 2015, 2016) and content analysis (e.g. Wright et al., 2002). Whereas, the study of informal learning within the context of digital games has been investigated with mixed-method studies (e.g. Barr, 2017, 2018, 2020; Iacovides, 2012). As such, the present research adopted a mixed-method approach, involving the triangulation of qualitative semi-structured interviews (RQ 1a and RQ 1b), a wider quantitative survey (RQ 2a and RQ 2b) and reflexive photography with photo-elicitation interviews (RQ3). Please see table 3 for a complete overview of the project.

**Phase 1: Semi-Structured Interviews + Narrative Survey**

| Timeline | Participants | Methods | Research Questions |
|---|---|---|---|
| January 2018 to May 2018 | 24 interview participants (16 male, 8 female, age range: 19 - 52).<br><br>14 Narrative survey participants (7 male, 7 female, age range: 21 – 57).<br><br>Different nationalities. Different game genres. | Sampling: convenience sampling used for participant recruitment.<br><br>Gaming habits and demographics questionnaire. Administered online.<br><br>Semi-structured interviews questions guided by literature review. Interviews took place over Skype.<br><br>Narrative survey frames based on interview questions. Administered online. | RQ 1a: How is creativity expressed within digital entertainment games?<br><br>RQ 1b: How do players themselves conceptualise creativity within digital entertainment games? |
| **Phase 2: Creativity in Digital Games Survey** | | | |
| **Timeline** | **Participants** | **Methods** | **Research Questions** |
| June 2018 to October 2018 | 251 respondents (160 male, 82 female, 6 nonbinary, 3 undisclosed)<br><br>Most common age bracket: 25 – 34<br><br>Different nationalities. Different game genres. | Sampling: convenience and targeted sampling focusing on female gaming groups.<br><br>Gaming habits and demographics questionnaire + 71 Likert style statements based on Phase 1 themes.<br><br>Principal Component Analysis with Varimax used to reduce survey items and highlight underlying constructs.<br><br>Bootstrap multiple regression used for analysing the relationship between transferability factor and remaining factors and between factors and learning outcomes. | RQ 2a: What do players learn from engaging in game-based creative practices?<br><br>RQ 2b: What aspects of game-based creativity are transferrable between games and real-life? |
| **Phase 3: Reflexive Photography + Photo Elicitation Interviews** | | | |
| **Timeline** | **Participants** | **Methods** | **Research Questions** |
| November 2018 to February 2019 | 9 reflexive photography participants (6 male, 2 female, 1 nonbinary, age range 22 - 38).<br><br>Different nationalities. Different game genres. | Sampling: participants recruited out of survey volunteers who indicated they wished to take part in further research.<br><br>Gaming habits and demographics questionnaire. Administered online.<br><br>Reflexive photography used to capture creativity in practice. Participants took screenshots over the course of a week of gaming instances which promoted or hindered creativity and selected up to three to discuss during the interview.<br><br>Photo elicitation interviews used to discuss screenshots with participants. Interviews took place over Skype. Question prompts focused on the gaming instances captured in the screenshots. | RQ 3: What specific game design affordances contribute to player creativity? |

*Table 3: Project Overview*

Mixed method research (MMR) consists of a combination of qualitative and quantitative approaches best suited to address the research question. MMR can be traced back to at least 1959 when Campbell and Fisk used a multimethod approach to investigate psychological traits (Campbell & Fiske, 1959). MMR involves triangulation of data sources, involving convergence of both qualitative and quantitative data. MMR can involve many different theoretical perspectives and methodologies, including concurrent (qualitative and quantitative data collected simultaneously), transformative and sequential strategies (Creswell, 2013).

For this research a sequential exploratory strategy was adopted. A sequential exploratory strategy involves a first phase of qualitative data collection and analysis, followed by a quantitative phase that builds on the findings from the first. A sequential exploratory strategy is primarily used to initially explore a phenomenon. As the research is concerned with a relatively under-studied topic, this strategy was deemed most suitable for two reasons. Firstly, how players express and conceptualise creativity has not yet been fully explored and thus we do not know what possible links there are between different expressions of creativity and learning, nor do we know what game design affordances may promote or hinder creativity. Secondly, through use of a quantitative survey, the findings from the interviews may be investigated in relation to a wider context and can be used to develop an instrument which seeks to determine the distribution of a phenomenon within a population (Creswell, 2013). The main purpose of this strategy is to utilise quantitative data to aid in interpretation of initial qualitative results and "enhance the interpretability of assessments of a single phenomenon via broader content coverage" (Greene et al., 1989, p. 257). Additionally, it can collect data in terms of the areas of learning where players develop skills from being creative and the other areas of life in which they use these skills.

The research took place over three phases:

Phase 1: Semi- structured interviews were used to explore how players express creativity within digital games, and subsequently, how they conceptualised creativity within the context of digital games. The interview questions were guided by existing literature around creativity and learning. Both deductive and inductive thematic analysis were used to identify the different expressions and conceptualisations of creativity. Additionally, initial themes relating to learning, transferability and design affordances were identified. This initial exploratory phase was used to inform Phases 2 and 3.

Phase 2: The findings from Phase 1 were used to inform the design of an online questionnaire around player creativity in digital games. The questionnaire aimed to generalise the findings regarding the expressions and conceptualisations of creativity in digital games, and examine to a wider extent, the skills and development players gained from being creative and the other areas of life that this learning transferred to.

Phase 3: The final phase focused on creativity in practice in digital games, with particular focus on the specific design affordances that facilitate and/or hinder player creativity. Reflexive photography alongside photo-elicitation interviews were used to explore this area. Design affordance theme framework uncovered in Phase 1 was triangulated and updated with the findings from the final phase.

Please see figure 9 for an illustration of the project phases.

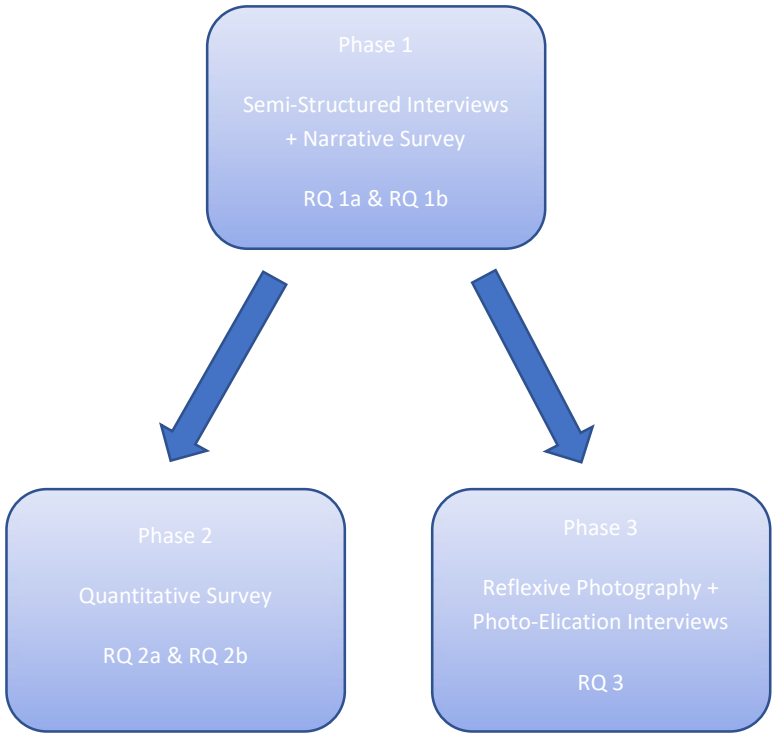



*Figure 9: Research Design*

## 3.3 Sampling

According to the Entertainment Software Association, the average age of those who play games is estimated to be around 35 (ESA, 2017). As this research is concerned with creativity, learning and transferability within the context of commercial digital games, the target population for study was those over the age of 18 and adults. No minors or vulnerable populations were included in the investigations due to ethical restrictions by the Open University's Human Research and Ethics Council (HREC). The main type of sampling used for all studies was convenience, however, targeted sampling was also utilised to address gender imbalance in Phases 2 and 3 by advertising on female gaming groups (see sections 6.1.3 and 7.1.3 for further details). In the UK, 42% of those

who play digital games are female (Ukie, 2017) and hence an even split as possible was the aim in relation to gender, however, it proved difficult to recruit a suitable number of female participants.

Participants were recruited via both online advertisements and word of mouth (i.e. participants hearing about the research through their friends, colleagues, etc). Advertisements were placed on social media such as Facebook and Twitter, popular gaming forums such as Steam and via games research mailing lists such as DiGRA's Games Research Network. Additionally, the most popular digital games were identified via the Entertainment Software Association (ESA, 2017) and UK Interactive Entertainment (Ukie, 2017) and advertisements were placed on both their official and unofficial forums.

While previous research on aspects of creativity and digital games has mainly concentrated on one type of game genre (e.g. Jarrett, 2016; Wright et al., 2002), participants who played a variety of different game genres, both online and offline, were recruited for all phases of the project. This enabled the different forms of creativity to be compared and contrasted across different types of games and allowed identification of the specific design affordances which contributed to creativity within the different game genres.

## 3.4 Phase 1 Methods: Semi-Structured Interviews and Narrative Survey

**Expressions and Conceptualisations of Creativity in Digital Games**

*RQ 1a: How is creativity expressed within digital entertainment games?*

*RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?*

Creativity can be suggested to be highly subjective and dependent on factors such as player personality, past gaming experiences and playstyles and, as such, qualitative approaches could be aptly suited to explore it. For example, Jarrett (2014) who examined emergent exploits and playstyles in MOBA games used an ethnographic approach, similar to Wright et al. (2002) who examined creative player innovations in verbal dialogue and non-verbal expressions. In contrast, creativity has also been studied using quantitative measures. For example, Yeh et al. (2016) used a quasi-experimental study to examine the influence of emotions on game-based creativity. They used the Creativity Game-based Evaluation System (CGES) which was comprised of a series of game-based insight tasks and a questionnaire agent to measure emotions. The insight tasks were adapted from the Situation-based Creativity Tasks (SCT) and comprised of various ill-structured problems where participants received points for each task solved. While creativity may be able to be measured quantitatively via divergent thinking tests and insight tests, they can be susceptible to practice effects (Plucker & Renzuli, 1999) and additionally, if participants are told they will be

engaging in creativity tests then their results can improve, rendering them unreliable (Speller & Schumacher, 1975).

A qualitative approach allows the researcher to explore the field, identifying patterns, phenomena and themes and to situate them within a meaningful context (Charmaz, 2006). Furthermore, as there is no unified conceptualisation of creativity in relation to the domain of games, the rich data from qualitative methods would be hoped to provide an insight not only into the different expressions of creativity in digital games, but also into how creativity is conceptualised from a player's perspective.

### 3.4.1 Instruments of Data Collection

Semi-structured interviews were used to explore how creativity is expressed within digital games, and how players themselves conceptualised creativity in the game. The semi-structured approach was chosen to provide participants with a structure for the interviews and help guide the discussion, however, also leave room for probing questions and discussion of related topics. Interview prompts were loosely guided by the initial categories of *creativity as problem-solving, creativity as appropriation* and *creativity as affective change* as well as literature on learning and transferability. Please see table 4 for a list of the interview questions.

| Question No. | Question Text |
|---|---|
| 1 | What platforms do you play on? |
| 2 | Can you describe a particularly engaging experience you have had recently whilst playing a game?<br>a. What do you think contributed to making these experiences so engaging? |
| 3 | To what extent do you feel you gained anything from these experiences? |
| 4 | Has there ever been a time when you tried out or created a new way of doing something – either on your own or in a team? |
| 5 | Have there been any times during your gaming experience when you began to view things in a different way? For instance, when your views were challenged or changed? |
| 6 | Tell me about a time when you encountered something new in a game such as a new monster, boss or event?<br>a. How did you go about tackling it? |
| 7 | Can you think about a time when you got particularly stuck in a game?<br>a. How did you overcome the issue? |
| 8 | Have you ever "discovered" a new way to go about something or use something in the game? (e.g. something you didn't know was there before) |
| 9 | Have you ever used the game mechanics for uses other than what they were intended for? (e.g. glitches, cheats, alternative uses for game variables) |
| 10 | Have you ever created anything for the game or based on the game such as modifications, walkthroughs or fanfiction?<br>a. What motivated you to do this? |

| | |
|---|---|
| 11 | Do you think you are or can be creative when you play games?<br>a. Do you feel you gain anything in particular from being creative in games?<br>b. Would you use any of the skills/experience from being creative in other aspects of life? |

*Table 4: Phase 1 Interview Protocol*

While interview data may provide a richer version of participant's experiences than a survey, the process can be time consuming both in terms of the time taken for the interview and the subsequent transcription of audio data. A total of 24 interviews were conducted, with a saturation point being reached after 16 interviews whereby no additional themes or new patterns emerged. Due to this, and the fact that more participants had volunteered to take part in the survey than was originally anticipated, the narrative survey was deemed an ideal additional research instrument to enable triangulation of interview findings.

Narrative inquiry has typically been used with small numbers of participants and is often used longitudinally with multiple instances of data collection (Lyons & LaBoskey, 2002; Polkinghorne, 1995). The aim of narrative inquiry is to enable participants to tell stories of their experiences. Data from narrative inquiry can be analysed on two levels: construction of the narrative form itself and that of the narrative content (Barkhuizen & Wette, 2008). In the case of this study, the narrative survey was used as a platform for participants to tell a story of their gaming experience, and hence, a content approach was taken using thematic analysis.

The use of "narrative frames" in the survey was employed to help scaffold the structure of participants' stories. Narrative frames were originally designed for research by Barkhuizen and Wette (2008) to capture the experiences of English language teachers in China. The method has since been used to explore the experiences and developments of teachers and students and as a needs analysis tool for EFL curriculum (e.g. Hiratsuka, 2014; Macalister, 2012; Shelley, Murphy, & White, 2013) . The use of such frames allows data collection within a relatively short period of time, as opposed to more traditional longitudinal methods of narrative inquiry. Frames consist of a template of "starters, connectives and sentence modifiers" (Wray & Lewis, 1997, pp. 122) to provide guidance and structure on the content of what is to be written. This is particularly useful if people find it difficult to get started in writing their experiences, or have difficulty writing "reflectively on a personal level, especially in a narrative form" (Barkhuizen & Wette, 2008, pp. 375).

The use of narrative frames in the case of this study provided a source of triangulation of data (Blandford, 2013). Interview questions were converted into frames with various prompts which participants could populate with their experiences. One drawback of narrative frames is the little opportunity they provide for participants to write about things outside of the structured content (Barkhuizen, 2014). In order to address this, an additional frame was provided where participants could add further information or comments. The creativity frame included a yes/no

question in relation to "do you think games are creative?". This allowed the frame to be split into two different paths depending on the participant's answer. However, it is noted that this introduces an element of binarism to the question, which in many ways could be seen as a grey area. See table 5 for the narrative survey frames.

| Frame | Question No. | Prompts |
|---|---|---|
| **Engagement** | Q1 | An engaging experience I have had recently with a digital game was…..<br>a. I found it particularly engaging because…<br>b. Other than enjoyment, I feel this experience helped me gain… |
| **Creative Game Actions** | Q2a | A time when I tried out or created a new way of doing something in a game was when….<br>a. I did this by… |
| | Q2b | A game which changed my views or made me view things differently was…<br>a. This was because… |
| | Q2c | A time when I encountered something I had never done in a game before was…<br>a. I managed to overcome it by… |
| | Q2d | A time when I discovered a new way to go about something or use something in the game was…. |
| | Q2e | An example of when I have used game mechanics for uses other than they were intended was when… |
| | Q2f | Material I have created for a game/based on a game would include….<br>a. I was motivated to do this because…. |
| **Views on Creativity** | Q3 | I think games are creative – yes/no<br>a. If yes, I think games are creative because…<br>a. When I am creative in games I feel I gain…<br>b. I feel I am able to use the skills/experience gained from being creative in other areas of my life such as…<br>b. If no, I think games are not creative because… |
| **Final Comments** | Q4 | Is there anything else you would like to add? |

*Table 5: Narrative Survey Frames*

### 3.4.2 Analysis

Thematic analysis was used to identify themes and patterns which contribute to an understanding of how creativity is expressed within digital games and how it can be conceptualised from a player's perspective. Thematic analysis is a "method for identifying, analysing, and reporting patterns (themes) within data. It organises and describes a data set in (rich) detail" (Braun & Clarke, 2006, p. 6). A theme aims to identify something important within the data, in relation to the research question and represents a pattern of meaning within the data set. While other qualitative analysis techniques such as Interpretive Phenomenological Analysis (IPA) and Grounded Theory are circumscribed within a pre-existing theoretical framework, thematic

analysis offers more flexibility in terms of its use within different theoretical frameworks. In essence, the judgement of the researcher plays a crucial part in determining what constitutes a theme – a theme needs to crystallise something important in relation to the research question (Braun & Clarke, 2006).

In this study, a hybrid approach to theme development was deployed using both deductive and inductive approaches (Swain, 2018). RQ1a was answered using a deductive approach whereby the categories of creativity as *problem-solving, creativity as appropriation* and *creativity as affective change* defined in the literature review were used to categorise data into the different types of creative expression. These were then refined further using an inductive approach to divide these categories further into higher-level sub-themes. Conversely, RQ1b was answered using a purely inductive approach and considered players' explicit conceptualisations of creativity in the gaming experience without reference to pre-existing literature. Other inductive themes identified related to learning, transferability and design affordances.

As theme development involved both deductive and inductive aspects, themes were determined across the entire set of interview and narrative survey data in order to explicate the most predominant and important areas. In line with this, fundamentality and frequency approaches were adopted, meaning themes were identified via both researcher interpretation and frequency of occurrence throughout the data set. While analysing themes in this regard may lose some depth and complexity (as opposed to focusing on one specific theme or group of themes in greater depth), it is most suited to areas which are under-researched or where participant's views on a topic are unknown (Braun & Clarke, 2006). Applying such a wide net to theme development further allowed for identification of areas of interest to be investigated in further phases, thus providing more depth and opportunities for triangulation of initially identified themes.

As this study was primarily concerned with an initial exploration of the area and involved two qualitative methods, a smaller sample size was used in line with other similar studies (e.g. (Jarrett, 2014; Voulgari et al., 2014; Wright et al., 2002) . While the results are not generalisable to the rest of the population, the subjective interpretations and experiences of the participant group is captured.  For more detailed information on phase 1 data analysis, please see chapter 4 (section 4.1.6).

## 3.5 Phase 2 Methods: Creativity in Gaming Survey

**Learning from Creativity in Digital Games**

*RQ 2a: What do players learn from engaging in game-based creative practices?*

*RQ 2b: What aspects of game-based creativity are transferrable between games and real-life?*

In a systematic literature review of empirical evidence concerning the impacts and outcomes of games, Boyle et al. (2016) found that the most commonly used methods to assess learning in entertainment games was quasi-experimental designs which, although they provide less rigour than a randomised control trial, still could provide evidence regarding why games may work for learning and what features can support it. However, it was noted that the most frequently occurring studies were those concerned with measuring a specified learning outcome and how player characteristics affect learning outcomes. While Boyle et al.'s (2016) review does not specify the intentionality of these learning outcomes on the part of participants, it does state that out of 71 studies which looked at entertainment games, only 15 addressed specifically unintentional affective outcomes such as behavioural change. As Boyle et al. (2016) notes, studies which examined social and behavioural outcomes tended to favour correlational, survey and qualitative designs.

In terms of informal learning outcomes from commercial digital games, the majority of studies reviewed in this report used either a mixed method or qualitative approach. For example, Barr (2017, 2018, 2020) used randomised trials, interviews and a cross-sectional survey to investigate graduate attributes such as communication and adaptability. Iacovides et al. (2014) used a mixture of interviews, case studies and a wider survey to investigate how gaming practices contribute to a range of different learning experiences. In a similar vein, Voulgari et al. (2014) used a mixed method approach consisting of individual and group interviews and a wider survey to examine informal learning outcomes and processes in MMOGs. Through utilising a mixed-method approach, studies such as these may provide a more thorough understanding of players' subjective experiences of learning and what may influence those experiences, while also being able to situate the results within a wider context through the use of a survey instrument. In contrast, a small number of studies focused purely on socio-constructivist notions of learning and used solely qualitative methods. For example, Hudson (2016) utilised an ethnographic approach to examine learning outcomes in an online gaming community and Oliver and Carr (2009) used interviews, informed by grounded-theory (Glaser & Strauss, 1967), on five couples to examine how people learn from play through in-game communities.

### 3.5.1 Instruments of Data Collection

A survey was deemed appropriate to use to firstly triangulate and locate findings from Phase 1 within a wider demographic, and secondly, to identify the specific skills that players gained from being creative and what other areas of life they used them.

The survey design consisted of three sections. The first section encompassed the consent information required to take part. The second section included questions relating to demographics, including age, gender, nationality, educational background and occupation, as well as questions relating to the participant's current gaming habits. These included how many hours a week they spent playing both online and offline digital games, what genres of games they played, what gaming medium they used and also what type of gamer they identified as, if any. The third section included a set of 71 attitude statements on a 5-point Likert scale relating to the themes developed in Phase 1. It was decided to include a multiple selection question for participants to select all the skills/knowledge they had gained from being creative in games and what creative pursuits they already engaged in, as it would enable further regression analyses to be performed. Learning categories were selected from the Phase 1 theme of *Learning* and collated with those from previous frameworks on informal learning outcomes such as the Gaming Involvement and Informal Learning (GIIL) framework (Iacovides et al., 2014) and Voulgari et al.'s (2014) framework for learning outcomes and processes in MMOGs. See table 6 for an overview of the creativity in gaming survey.

| Section | No. Questions | Question Format | Description |
|---|---|---|---|
| **Consent** | 5 | Check boxes | Basic consent information. |
| **Demographics and Gaming Habits** | 5 | Drop down selection | Demographic information relating to age, gender, nationality, educational background and gamer type identified as. |
| | 4 | Multiple selection | Questions relating to game genres played, gaming mediums used and creative pursuits engaged in. |
| | 5 | Open-ended | Information relating to hours spent playing offline/online digital games (numerical input), occupation and current games being played. |
| **Creativity in Gaming Questionnaire** | 71 | 5-point Likert scale | Scale questions relating to the Phase 1 themes of: conceptualisations of creativity, creativity as problem-solving, creativity as appropriation, creativity as affective change, learning and transferability. |
| | 1 | Multiple Selection | Multiple selection question relating to skills developed/knowledge gained from being creative in games. Participants could select multiple skills/developments. |

| | | | |
|---|---|---|---|
| **Feedback** | 3 | Open-Ended | Feedback questions relating to ease of understanding questions, recommendations or improvements and additional comments. |
| | 3 | Single Choice | Single choice questions relating to if participants wished to receive resulting publications/thesis, notifications of other research opportunities related to the project and/or a summary of the findings. |

*Table 6: Creativity in Gaming Survey Design*

The survey was administered via the platform Online Surveys (formerly known as Bristol Online Surveys) where data is stored securely in the UK in accordance with The Open University's Data Management guidelines. For a full list of survey questions please see appendix 1.

### 3.5.2 Analysis

Data analysis was carried out using SPSS. Data was subjected to Principal Component Analysis to converge and reduce the number of scale items in the survey. To address RQ2a, multiple regression was used to determine whether scores on the factors relating to forms of creative expression (*problem-solving, appropriation* and *affective change*) were predicted by reported learning outcomes. To address RQ2b, multiple regression analyses were conducted to a) determine whether scores on the *transferability* factor were predicted by the other four factors (*problem-solving, appropriation, affective change* and *design affordances*), and b) determine if scores on the *transferability* factor were predicted by reported learning outcomes. For more detailed information on phase 2 data analysis, please see chapter 5 (section 5.1.6).

## 3.6 Phase 3 Methods: Reflexive Photography and Photo-Elicitation Interviews

**Design Affordances for Creativity in Digital Games**

*RQ 3: What specific game design affordances contribute to player creativity?*

Phase 1 sought to initially explore the under-researched area of creativity in digital games, and Phase 2 attempted to both generalise these findings and investigate the relationships between creativity, learning and transferability. Phase 3 aimed to further explore the relationship between game design and player creativity by building on the Design Affordances theme from the first phase. Design affordances was chosen as the focus of this study for three main reasons: a) this was an inductive theme from phase 1 which resulted in the creation of an initial framework detailing how design elements of games related to player creativity and hence provided an initial basis on which to further explore and b) very little literature currently exists detailing how the design of digital games affect player creativity.

### 3.6.1 Instruments of Data Collection

In order to capture player creativity in practice and unpick the specific design affordances which contributed to these instances, reflexive photography in combination with photo-elicitation interviews was deemed the most suitable method.

Through giving participants the flexibility and agency to capture important aspects of the games they enjoy, at the time they enjoy, and for the duration they prefer, provides optimum opportunity to capture any creative behaviour which would naturally occur. Although interviews would take place at the end of the study, the use of images as memory cues will aid in recall. As Collier (1967) notes, the identification and reading of photographs can act as a "can-opener" or "golden key" to human settings, while participants are able to take the role of experts who teach the researchers.

While reflexive photography has not been used as an approach to investigate gaming experiences, the method has been used to examine a range of learning experiences. For example, Wallace (2015) used reflexive photography alongside focus groups and interviews to examine International Teaching Assistants (ITAs) experiences using Computer-Assisted Language Learning (CALL) for English. ITAs photographed what helped or hindered their efforts to improve their spoken English, and through triangulation of photographic data, focus group discussions and semi-structured interviews, a rich and detailed understanding of their subjective experiences was gained. Photographs can act as insights into participant's experiences and attitudes, as well as providing a powerful means of reflection when they are used in combination with interviews (Rose, 2007).

Originally derived from the work of Paulo Freire who used "coded situations" (e.g. sketches or images) to act as a stimulus for a group or individuals to critically analyse their own situation (Shulze, 2007), reflexive photography is grounded in individual-environmental interaction theories and symbolic interactionism – mainly that behaviour is a result of the interaction between individuals and their environment and the particular meanings that individuals ascribe to things. It has been claimed that using photographs promotes participants to think more thoroughly about the issues under study (Wallace, 2015). For example, studies by Douglas (1998) and Hill (2014) reported that participants spent more time thinking about the meaning of the images they captured, how best to capture their ideas and what images they wanted to share with the researcher. In addition, photographs are especially useful in the case of language or writing barriers where participants may not feel confident enough to fill out a full diary entry or appear in a video entry. They are also useful in saving time instead of having to fill out long diary entries and creating videos.

In previous studies which used reflexive photography (e.g. Schulze, 2007; Wallace, 2015), participants have been provided with cameras or have made use of their own smartphones. With games, however, participants can take screenshots of relevant situations and objects within the game – a feature which most gaming mediums now offer. As gameplay is often engaging and participants may be in a flow state, the act of physically taking a photo may disturb the experience. Taking a screenshot does not take the participant away from the game and usually involves minimal disruption. Additionally, this addresses one of the drawbacks of using reflexive photography which has been reported in previous studies; namely the appropriateness and ease at which participants are able to take pictures. For example, Schulze (2007), who investigated how male academics construct their world during a transformative time in their university, found that some situations made it difficult to take pictures (e.g. long queues, the problem of permission when photographing someone else). Through adapting this method for the use in games; namely by capturing screenshots of the in-game world, participants are free from the constraints of physically taking a picture.

In the context of this study, participants took screenshots (usually involves pressing a single button on their keyboard or short combination on controller) of a gaming instance which invoked them to think creatively or led them to undertake creative action – and conversely, in instances where they felt their creativity was being restricted or inhibited. This aimed to explicate the role of in-game environmental and social factors which may contribute to creativity. Additionally, it also provided a view into the subjective interpretations that individuals ascribe to scenarios which they feel induce elements of creativity. Similar to Schulze's (2007) and Wallace's (2015) studies, photo-elicitation interviews were conducted with each participant.

In photo-elicitation interviews, the photographs serve as the central point of focus, with the interviewee interpreting the images retrospectively (Harper, 1994). One way of achieving this is through autodriving, where the interview is "driven" by participants' reflection of their own behaviour (Heisley & Levy, 1991). Using photographs in interviews can illuminate participants' experiences, attitudes and perceptions and can "carry or evoke three things – information, affect and reflection"(Rose, 2007, p. 238). Through allowing participants to define the scope of analysis by identifying issues important to them, photo-elicitation interviews are less directive than traditional interviews and the influence of researcher bias is minimised (Bender et al., 2001).

In the current study, data collection took place over a two-week period with the first week involving participants taking screenshots during their regular gaming sessions and the second week involving the photo-elicitation interviews with each participant individually. Interview questions centered on the gaming instances captured in the screenshots and were guided by existing themes from Phase 1 relating to creative design affordances. The same set of

questions were asked for each screenshot discussed in the interview. Two additional questions were included at the end to allow participants to add anything else they felt relevant and to give feedback on the reflexive photography method and how successful they felt it was in terms of capturing instances of creativity in gaming. As a thank you to participants for their time in participating in the study they were offered a £10 or international equivalent Amazon voucher. Please see table 7 for a list of interview questions.

| **Photo Elicitation Questions (repeated for each of participant's screenshots)** | |
|---|---|
| **Question No.** | **Question Text** |
| Q1 | Can you tell me what was going on in the game when you took this screenshot? |
| Q2 | What were you hoping the screenshot would capture? |
| Q3 | How would you describe the creativity involved in this screenshot? |
| Q4 | What aspects of the game enabled you to behave in this way/do X or Y? |
| Q5 | Had you ever had similar gaming experiences or was this a one off?<br>a. Do you feel these/this type(s) of game(s) allow for greater creativity? |
| **Concluding Questions (only asked once at the end of the interview)** | |
| **Question No.** | **Question Text** |
| Q6 | Is there anything else you would like to add? |
| Q7 | Do you have any comments or feedback on the methodology used?<br>a. Do you feel the reflexive photography method worked well in capturing instances of creativity during gaming? |

*Table 7: Phase 3 Interview Protocol*

### 3.6.2 Analysis

Reflexive photography combined with photo-elicitation interviews allows analysis on two levels. Firstly, the content of the images can provide useful data. An image can contain numerous references and rich descriptive data about the issue in question (Perka et al., 1992; Collier, 1967). While the images themselves were not analysed per se, they were used to provide pictorial references for the themes created.

Secondly, interview transcription data was analysed, in a similar fashion to Phase 1, using a hybrid approach (Swain, 2018) to theme development. Deductively, the pre-existing themes relating to *design affordances* from Phase 1 were used as an initial means of categorisation, however, an open and interpretive stance was taken allowing for the refinement of existing themes and the emergence of inductive themes. For more detailed information relating to phase 3 data analysis please see chapter 6 (section 6.1.6).

## 3.7 Ethical Considerations

The study followed and complied with the British Psychological Society's Code of Human Research

Ethics (BPS, 2014).

Game specific issues with the potential to pose a risk in the study were:

- The risk of computer related repetitive strain injury (RSI) in phase 3 where participants captured screenshots of their gaming experience over the course of a week. Computer related RSI involves injuries such as eye, back and neck strain. In order to address this, participants were provided with information on computer-related RSI alongside a link to the NHS Choices website detailing tips to prevent computer-related RSI (found at:http://www.nhs.uk/Livewell/workplacehealth/Pages/rsi.aspx).

- The risk of virtual environment (VE) related psychological side effects. As Kade and Daniel (2015) note, when conducting research into games and virtual environments, VE related psychological side effects must be taken into account. As such participants in phase 2 were provided with information pertaining to possible VE-related psychological side effects. This included effects such as cybersickness, altered sense of reality and limited self-awareness and provided tips on how to monitor play time as to reduce these.

Online Surveys (formerly Bristol Online surveys) was used to carry out participant recruitment for phases 1 and 3 and the quantitative survey in phase 2. This was chosen both for its ease of use (for both participants and researcher design), and because the data is stored in the UK. This complies with EU and the Open University's Research Data Management standards. Before any data collection was carried out, full approval from the Open University's Human Research Ethics Committee (HREC) was acquired (reference: HREC/2613/Hall).

The advertisement for participants included a brief description of the research and a link for them to follow to the online recruitment survey. The recruitment survey provided more information on the study and research aims, outlining clearly what was expected of participants in each study instance. Further information was provided in terms of:

- Name and contact details of the researcher and supervisors.
- Potential benefits of the research.
- Compliance with the General Data Protection Regulation and Freedom of Information Act.
- Confidentiality and the right to withdraw from the research up until the date of analysis completion.
- The right to refuse particular information requested by the researcher (e.g. in the case of declining to answer interview questions).
- The right to request data be destroyed (up to the data of analysis completion).

- How anonymity of data was achieved (through the use of unique participant identifiers).
- The methods used to collect the data (interview, visual and survey) and how it was used (for academic purposes).
- What types of data were to be collected (qualitative and quantitative) and where they were stored.
- A consent form requiring an electronic signature from the participants.
- A full copy of the information sheet for each study which participants could can retain for their records.
- Participants were able to select if they wished for a findings summary and/or the final research to be sent to them once completed.
- Participants were given the option to join the mailing list for the PhD project where they could be notified about further studies related to the project.

The benefits of the research to participants include contribution to the wider research context of creativity in digital games and informal game-based learning. Additionally, in the context of phase 3, participants may be able to gain a better understanding of their individual gaming practices through reflection on the screenshots they took over the course the reflexive photography week.

Additional ethical considerations taken into account during the course of this project were:

- Participants were aged 18 and above and did not include any vulnerable groups such as those lacking capacity to give informed consent or those in dependent or unequal relationships. If competence to consent was questionable, follow up procedures were to be carried out to investigate the participant's understanding of what they were consenting to.
- The research involved no element of deception, with participants being fully aware of the nature of the research prior to the commencement of studies.
- The research did not involve foreseeable psychological stress or anxiety. Participants were talking about their experiences of playing digital games, and in the case of phase 3 (reflexive photography), were engaging in gameplay within their own milieu in which they were comfortable. Participants were not engaging in gameplay within lab or other artificial settings.
- All data was stored in the same place (including consent forms) and backups were created on at least two different data mediums (e.g. encrypted pendrive and Open University Onedrive). This limited the risk of loss or corruption of data.
- In the case of participant screenshots from phase 3, the screenshots are recognised as property of the game developer of which they pertain to.

- Any instances of named avatars, other than the participant's, appearing in screeenshots were to have names changed as to not identify any particular avatar pertaining to an individual.

*[This page is intentionally left blank]*

# 4. Phase 1: Expressivity of Creativity and Player Conceptualisations of Creativity in Digital Games

This study constituted the first phase of the project which took an exploratory approach to examining creativity in digital games. The aim of the study was to a) examine how creativity was expressed in relation to pre-existing literature on creativity in gaming and b) explore how players conceptualised creativity (i.e. their own personal idea of what it means to be creative in games). As such the research questions for phase 1 were:

*RQ 1a: How do players express creativity within digital entertainment games?*

*RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?*

While the main focus was on the conceptualisation and expressivity of creativity, questions relating to other constructs around creativity such as learning (from being creative), creative transfer and design affordances for creativity were included in the interview questions and helped both inform subsequent research questions provide initial data for the later phases of the project. As such, the initial findings relating to learning from creativity, creative transfer and design affordances are presented and discussed.

Section 4.1 details the technicalities of the study such as recruitment procedures and demographics, in addition to providing an overview of participants involved. Section 4.2 presents the findings and discussions in relation to how creativity is expressed and conceptualised, as well as presenting findings relating to the circumferential themes of learning, transferability and design affordances. The findings relating to learning, transferability and design affordances will also be discussed. Section 4.3 provides a conclusion and section 4.4 outlines the limitations of the study along with future recommendations. A final section (4.5) will explicate the implications of the study.

## 4.1 Participants and Demographics

### 4.1.1 Piloting

Piloting was carried out with four participants aged between 32 to 40 years old (M = 2, F = 2). All four participants who took part in the pilot played digital games at least three times a week and all played a mixture of online and offline digital games except for one who solely played online. As no amendments were required for the interview question list, the pilot data were included in the main analysis.

### 4.1.2 Interview Participants

The aim for participant recruitment for the main study had initially been 16 participants as this would bring the total number of interviews (including the pilot) up to 20, however, due to a greater number than expected volunteering to take part, 20 interviews (bringing it to a total of 24 with the pilot interviews). 117 participants in total completed the recruitment survey from the study advert. Six responses were excluded as they were under 18, did not regularly engage in digital gameplay or their email addresses came back as unrecognised. 64 participants were emailed the first letter, of which 29 then went on to complete the consent and gaming habits survey. Of these 29, interviews were arranged with 21 participants, the remaining 8 comprising of those who did not go on to schedule an interview. One interview had to be excluded due to research bias, leaving a total of 20 interviews.

Of the 20 interview participants, 14 were male and 6 female. Ages ranged between 19 – 52 years old with the median being 33 ($M$ = 30, $SD$ = 7.4). In terms of nationality, 12 participants were of British, 2 German, 2 Spanish, 1 American, 1 Maltese, 1 Northern Irish and 1 did not disclose. In terms of educational background, 2 were from high school, 4 from college, 6 with an undergraduate degree, 5 with a postgraduate degree, 1 with a doctorate and 2 who specified other.

16 participants regularly played online digital games, 18 regularly played offline digital games and 8 regularly played co-located digital games. Regular gaming sessions lasted from 1 hour to 13 hours, with the median being 3 ($M$ = 3.6, $SD$ = 7.8).

Participants played a range of different game genres. The most common online genres were Massively Multiplayer Role-Playing Games (MMORPGs), Massively Multiplayer First-Person Shooters (MMOFPS) and Massively Multiplayer Battle Arenas (MMOBA). The most common offline genres were Action/Adventure, Role Playing, Platform, Strategy/Tactics and First-Person Shooter.

### 4.1.3 Narrative Survey Participants

Once the interview quota of 20 participants was met, all additional participants who signed up (*n*=97) and had not already been sent the first correspondence were sent an email explaining that there would be a further round of data collection via a narrative survey. The email also detailed the ethical points such as right to withdrawal and how the data would be managed. The link to the narrative survey was included in the email for ease of access.

In total, 97 participants who completed the recruitment survey were emailed the narrative survey link. The survey was available for three weeks and in that time 14 participants completed it (7 male, 7 female). Age ranged from 20 – 63 years old with the median being 31 (*M* = 36, *SD* = 13.6). The nationality of participants was: 6 British, 4 American, 1 Australian, 1 Canadian, 1 Colombian and 1 Spanish. In terms of educational background, 5 had postgraduate qualifications, 3 had undergraduate, 3 doctorates, 2 college and 1 high school.

11 out of 14 participants played online digital games and 11 out of 14 played offline digital games. The median gaming session lasted 1.86 hours (*M* = 2.4, *SD* = 1.1). The most popular online game genres were First-Person Shooter (MMOFPS), Role Playing (MMORPG), Real Time Strategy (MMORTS) and Battle Arena (MMOBA). The most popular offline game genres were Action/Adventure, Role Playing, First-Person Shooter, Strategy/Tactics and Indie.

### 4.1.4 Recruitment

The study advert was posted on the principal researcher's Facebook, as well as to a game-related Facebook group and the departmental PhD group. Additionally, the advert was posted to Twitter and tweeted to various gaming groups such as @zeldaspeedruns, @instituteofplay and @GamerRetweeters. Hashtags used were #MMORPG, #MMO, #Videogame and #gaming. In order to acquire a spread of players who played different types of games, a longer version of the advert was posted to various gaming community forums such as Steam, Origin and modding and speedrunning forums.

The advert contained a link where participants could read a summary of the study and what would be involved and could provide their email address and confirm they were over the age of 18 if they wished to take part. From the recruitment list, participants were then emailed the first letter outlining the main requirements of the study, as well as ethical issues such as freedom to withdraw. Participants were asked to respond to this email if they still wished to take part, and those that did, were emailed the consent and gaming habits questionnaire along with the study information sheet.

Participants who completed the interview were rewarded with a £10 (or nearest international equivalent) Amazon voucher. Participants who signed up for the narrative survey were given the opportunity to enter into a prize draw for a £20 or equivalent Amazon voucher.

### 4.1.5 Data Collection

All surveys/questionnaires were conducted via Bristol Online Surveys (BOS) where all survey data are stored securely in the UK in accordance with the Open University's data management policy.

All interview participants were asked to complete the consent and gaming habits questionnaire (included in appendix 1). The gaming habits questionnaire acquired demographic information such as age, gender and educational background as well as what types of games participants played and how long gaming sessions lasted. List of popular game genres was adapted from GameDesigning.org's complete guide to video game genres (https://www.gamedesigning.org/gaming/video-game-genres/).

Interviews were conducted via Skype, using Amolto Call Recorder for Skype for recording. Additional verbal consent was sought from participants at the beginning of interviews regarding audio recording. Interviews lasted between 10 minutes and 1 hour, with the average interview session lasting 39 minutes. Audio recordings were transcribed using simple content transcription. Narrative frames were already in text format and were not altered in any way (e.g. typos and grammar not corrected) and were quoted from directly.

### 4.1.6 Data Analysis

Data analysis for both the interview and narrative survey data was undertaken using thematic analysis in NVivo 11 (https://www.qsrinternational.com/nvivo/nvivo-products). While three predominant categories of game-based creativity had emerged during the literature review, a hybrid approach (Swain, 2018) to theme development was applied. This included combining both deductive and inductive approaches by keeping in mind the existing creativity categories from the literature review whilst also ensuring an open-minded view was taken when analysing sources.

In line with the pragmatic approach to qualitative analysis, themes were identified according to their fundamentality and frequency of occurrence throughout the whole data set (both interview and narrative survey data) (Adams et al., 2008). This involved identifying themes which related most pertinently to the research question; namely how players expressed creativity in games and how players conceptualised the notion of creativity in digital games. While part of the analysis was deductively guided by the research question and literature, the other part

involved inductively identifying emerging patterns through the frequency of references. In this way, additional themes were uncovered along with their possible relationship to the research question.

Themes were developed using an iterative approach. This involved in the first stage generating a simple set of nodes encapsulating a low-level theme such as *creativity as affective change*. Through further iterations which involved reading and re-reading through the node references, themes were able to be further refined into high-level nodes encompassing sub-themes such as the *creativity as affective change* sub-theme of *moral*. For more information on the data analysis see section 3.4.2.

## 4.2 Findings & Discussions

In total the data from 24 interviews and 14 narrative surveys were analysed. Each theme will be presented and discussed in turn.

### 4.2.1 Forms of Creative Expression

In relation to *RQ 1a: How do players express creativity within digital entertainment games?* the themes of *Creativity as Problem-Solving*, *Creativity as Appropriation* and *Creativity as Affective Change* corresponded to how creativity was expressed in digital entertainment games.

The three themes were identified deductively which related to the expression of creativity in digital games in relating to pre-existing creativity categories identified in the literature review (problem-solving, appropriation and affective change). These expressions of creativity were often implicit as participants did not always explicitly state that they were engaged in creative action. See table 8 for an overview.

| **Expressivity of Creativity Themes** | **Description** |
|---|---|
| Creativity as Problem-Solving | Creativity relating to creative problem-solving such as experimenting with strategies, trial and error approaches, methods of preparation for challenges. |
| Creativity as Appropriation | Creativity relating to the appropriation of gameplay such as using glitches, finding new uses for game mechanics and creating additional challenges. |
| Creativity as Affective Change | Creativity relating to affective change, often instigated by emotionally challenging game narratives. Includes ways in which games have provoked further thought, changed views and enabled new insights to be gained. |

*Table 8: Forms of Creative Expression Overview*

#### 4.2.1.1 Creativity as Problem-Solving

Creativity as problem-solving involved how creativity was expressed in digital games in terms of personally novel solutions to problems, discoveries and ways of approaching difficult challenges players generated. See table 9 for sub-theme descriptors.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Creativity as Problem-Solving | Creating Strategies | This theme refers to instances when a player creates strategies to use in the game, whether it is defeating a boss or creating tactics to use against other players in a competitive environment. This can either be done alone or within a team. |
| | Approaching Problems | This theme relates to the planning involved before deploying a strategy or set of tactics. A specific way of approaching different problems. |

*Table 9: Creativity as Problem-Solving Sub-Theme Descriptors*

#### 4.2.1.1.1 Findings

*Creating strategies* was the most frequently occurring expression of creativity. The majority of games participants mentioned involved some form of problem-solving in the form of creating strategies or tactics. References from participants included instances where strategies were created with group members online as well as while playing solo offline.

> *"We'll come together and someone will be like the leader perhaps or the old pitch in thing, why don't we try doing this, where. For instance, on Overwatch there's a map called Temple of Anubis where they have characters which can build ice walls. And there's a site line where you can get one of them up to this high point. Some of the characters can't reach that area. So using the ice wall to climb up above this area so we can get a good viewing of where the enemy team might be coming in, and from there it's all creating communication really to see how it works and what works and doesn't."* – Male, 23 (Interview)

Strategies created in online games usually involved tactics against other player teams, except in the case of one participant who recounted his gaming experience in *World of Warcraft* (Blizzard Entertainment, 2004) leading a raid team. A "raid" is a special dungeon within the game with very difficult bosses, often requiring complex strategies to defeat. Developers release new raids periodically throughout the year, so players have to constantly discover new strategies.

> *"So a lot of the time I'll do my best to explain strategies, that sort of thing. But I'm not perfect and I've got no issues admitting my mistakes, so if something's not working we all band together and all field ideas and we'll try them out. We'll give a couple of attempts for each person's idea, providing that there's some logic behind it."* – Male, 27 (interview)

In terms of offline, single player games participants also cited trying different strategies. This was either due to encountering a difficult task or enemy or else choosing a different way to play the game such as a different character class or mode.

> *"The Venice faction in Civilization 5 gave me a totally new experience of the game. Venice*

*can't settle new cities - all they can do is 'buy' neutral cities (city states) around the world through influence. Playing this way removes the aggressive conquest aspect of the game, and requires you to play a lot more strategically using trade routes and diplomacy to spread your influence."* – Male, 29 (Narrative Survey)

Often strategy formulation was experiential and involved instances where participants adopted a "trial and error" approach to challenges. This approach involved a lot of practising and undertaking the challenge in question multiple times. This was especially evident in games such as *Monster Hunter: World* (Capcom, 2018) and *Dark Souls* (FromSoftware, 2011) which involved a variety of bosses each requiring a particular strategy to defeat. The repeated post-defeat reflection allowed participants to then discover the optimal strategy for these particular challenges.

*"Usually what I would do is kind of throw myself at it and see how far I get on kind of pure blind luck and reflexes and then, you know, the assumption is not very and then you go and work out why and kind of sort of almost pick apart what you did right and what you did wrong and then have another go and refine it and refine it."* – Male, 41 (Interview)

Other instances where players created strategies included with friends and relatives while playing together in the same location or else during co-op campaigns. One participant (male, 21, interview) cited playing *Portal 2* (Valve, 2011) with his father who was unwell at the time and unable to engage fully with the game, so instead of using the more complex co-op mechanics that the developers had intended the participant created a strategy where he would simply bounce of the other character's head (controlled by his father) to reach a button.

*"Although I have completed the Portal 2 co-op campaign on my own…[my] dad was trying to help with it and then was quite ill so couldn't really get his head around the puzzles. So there were a few moments of sort of OK just stand there, I'm going to bounce off your head and get the button, but really we should be sort of flinging each other to."* – Male, 21 (Interview)

*Approaching problems* involved the planning and preparation involved before strategies were enacted. This included instances where players specifically spent time researching certain aspects of the game before play as well as how players approached instances in games which they had never experienced before.

*"(On playing the online FPS Overwatch for the first time) Lots of practise and positive thinking. Taking it slowly to avoid anxiety playing online for the first time."* – Female, 21 (Narrative Survey)

Unlike in *creating strategies* where the successful strategy was unknown, in *approaching problems*, the general strategy was usually already anticipated through previous knowledge or

experience.

> *"You get something and you think that's definitely going to have to be used later, and you just figure out the dots before the dots are even there."* – Female, 29 (Interview)

While this still did not guarantee a solution, it was able to provide a certain amount of scaffolding to difficult challenges. This included ways participants coped with times when they were "stuck" in the game – such as trying to work it out themselves before "going on GameFAQs" (male, 31, interview) or "taking a break and going back to it later" (male, 19, interview). Most participants cited they preferred to try and "have a go" at challenges themselves first, and only used guides as a last resort when they couldn't see a way to move forward with the game.

Participants also referenced instances where they had discovered something new about the game which could be used to make a part of the game easier, such as one participant (male, 23, interview) who discovered a different route in *Persona 5* (Atlus, 2016) which could be used as a shortcut in the future. Other common examples included participants discovering game mechanics when there was no in-game tutorial or instructions.

> *"When I was playing Ark, there were no instructions as how to survive or make equipment. I had to discover how to make tools and upgrade my items, something which was very new to me as I'm used to having instructions."* – Female, 29 (Narrative Survey)

In conclusion, participants cited instances of creativity in games which included *creating strategies* involving problem-solving, reflective thinking and trial-and-error approaches. Additionally, creativity was expressed in terms of the novel ways in which players *approached problems*. This included reading about the challenges beforehand, discovering game elements that while not useful immediately may be useful later in the game, and taking breaks when things became too frustrating.

#### 4.2.1.1.2 Discussion

In *creativity as problem-solving*, the creative actions were primarily focused on overcoming ill-structured problems. Problems are said to be ill-structured when there are multiple possible paths to overcome a challenge, often with unclear goals and incomplete information (Hong, 1998); something which is especially evident in open-world games. Playful activities such as games have been argued to provide opportunities to approach situations in unique ways, free from external constraints and, thus, freeing individuals from "means-end" thinking, allowing the formulation and adoption of novel solutions (Getzels & Csikszentmihalyi, 1976; Mainemelis & Ronson, 2006; Russ et al., 1999; Sternberg, 1988). In this sense, creativity involves two elements: firstly, the solution must be successful in solving the problem and secondly, the solution must be novel in relation to the individual. In this way, the same response can be creative for one

individual and routine for another who is merely repeating the solution previously created (Mayer, 1983; Weisberg, 1986).

For all the *creativity as problem-solving* categories the actions of players were a result of trying to overcome a problem. Participants cited that they almost always tried to "figure it out" themselves before consulting guides for a solution or strategy. This sense of discovery often added to the overall enjoyment of the game, tying in to the argument that modern digital games are effective learning tools as they emphasis active learning while creating a sense of satisfaction and intrinsic motivation in players (e.g. Boyle et al., 2011; Gee, 2003b). Participants spoke about refining their strategies through "a process of elimination" and "picking apart" the outcome to determine what they did correctly and what went wrong. The constant reflection and refinement involved in the creative problem-solving process can be illuminated by Kiili's (2005) Experiential Gaming Model (EGM) which describes how games may act as means of for players to develop their creative problem-solving skills. The creation of solutions to these challenges takes place twofold: firstly, within an unstructured and chaotic phase where the player does not take notice of the wider restraints of the game world, and secondly, within a refinement phase, where ideas are contextualised in relation to the constraints, resources and limitations of the game world. Through such reflective observations, motivated by a flow state, players are able to hone their creativity by overcoming ill-structured challenges (Kiili, 2005). Furthermore, the sense of achievement which comes from "working it out" may act as a motivator for creativity, something which is in line with Gee's (2003) Discovery Principle which states that games are especially good at providing players with the opportunities to experiment and make their own discoveries.

Despite participants citing that they preferred to persevere and try and work through things themselves, there were times when challenges could become too much or too frustrating leading to a breakdown in gameplay. Breakdowns can include instances where existing strategies no longer work (Ryan et al., 2009) and where the flow of gameplay is interrupted (Barr et al., 2007). This often led to players invoking different strategies such as consulting external resources such as guides or friends, as well as taking breaks. Similar findings are echoed by Iacovides et al. (2014) who examined the various strategies that players create to manage gameplay breakdowns. They found that players would employ multiple strategies such as trial and error, repetitions and experimenting. After repeated gameplay breakdowns, players would often use the "Stop and Think" strategy which involved taking a brief break from playing to reflect on how best to proceed (Iacovides, Cox, et al., 2014). Participants in the current study cited that when a challenge became too much or too frustrating they would "take a break", which would often result in a couple of days break from the game in question. As well as being a strategy to allow for reflection on the particular challenge, it also doubled as a strategy for coping with the negative feelings surrounding the breakdown, allowing the player to calm down. Such breakdowns of gameplay and

subsequent strategies used by players to overcome it has been argued to contribute to learning (Pelletier & Oliver, 2006). Furthermore, "taking a break" may serve as a facilitator for creative incubation (Hélie & Sun, 2010; Sawyer, 2013), and subsequently insight moments (Schooler & Melcher, 1995) which contribute to the development of solutions.

In addition to participants mentioning creative problem-solving in relation to solo contexts, many also mentioned creating strategies and tactics as part of a team effort. This included playing with guild members or friends online as well as playing within the same physical location with friends and family members. In terms of massively multiplayer online games, players are given the freedom to play cooperatively or competitively with others online. Participants who engaged in online play cited a motivational factor being the social aspect involved, a finding in line with other research into MMOGs (e.g. Herodotou et al., 2014). It has been suggested that creativity is grounded in social and individual experience as well as emotions and fantasy (Vygotsky, 2004). In terms of creative actions within online teams, participants cited collaborative strategy creation as being a main source of enjoyment and motivation for play. This is in line with the argument that creativity not only exists in solo contexts, but also in collaborative processes involving team based problem-solving, communicating, blending and reconfiguring ideas (Ferguson, 2011) as well as "interthinking" (Leach, 2001; Mercer, 2000). It has been argued that when a group shares a challenge and initiates a collaborative brain-storming session, each member of the group is able to build on and expand one another's ideas for future possibilities, promoting creativity and "out-of-the-box thinking" (Bell, 2010). This was something which was referenced by several participants when mentioning instances of collaborative strategy formulation. The collaborative creative problem-solving participants cited often involved taking risks in terms of trying out different tactics that had not been previously used. The affordances for risk taking which ill-structured challenges in games present can be suggested to promote creativity, both in and outside of the game.

In conclusion, one manifestation of creativity in games related to finding novel and unique solutions to problems. It should be noted, however, that the novelty of solutions and approaches is individual specific, meaning what is novel for one player may already be old knowledge to another. In this way, the expression of creativity is more synonymous with the Little C approaches such as Richards et al.'s (1988) *everyday* creativity and Maslow's (1968) *self-actualizing* creativity which argue that that everyone has creative ability to some extent, and this ability can be developed further usually through the application of everyday creativity to solve and overcome problems (Richards et al., 1988). *Creativity as problem-solving* was also the most common theme which participants explicitly linked to learning instances, predominantly in terms of cognitive skills. Additionally, many participants cited using the skills gained through these creative instances in other areas of their life such as work, or general life skills. This did not solely

include cognitive skills associated with creativity, but also the transfer of ideas from the game to other settings (or in a few cases vice versa).

#### 4.2.1.2 Creativity as Appropriation

This theme referred to instances where participants had played games in ways which had not been intended, often going above and beyond what developers expected. See table 10 for theme descriptors.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Creativity as Appropriation | New Use for Existing Game Mechanic | This theme related to the ways in which players were able to discover and use game mechanics for alternative uses. |
| | Glitches | This referenced the use of glitches in order to make the game easier to play or for fun. |
| | Creating New Challenges | This theme related to instances where players had created new games or goals within the game or deliberately created additional challenges, such as upping the difficulty level or finding alternative, more challenging ways to play a game. |

*Table 10: Creativity as Appropriation Sub-Theme Descriptors*

##### 4.2.1.2.1 Findings

The sub-theme *new use for existing game mechanics* referenced instances where participants had found alternative uses for existing game mechanics, usually in order to find shortcuts through a game, overcome a challenge or create an additional challenge within the game. Often, participants cited discovering these uses on their own through experimenting with game variables, or else by accident.

> *"There's an item in Divinity: Original Sin. I found that everything in the game has a weight as a value. So an apple will weigh 100g but a water barrel will weigh 100kgs…I found that you could put four barrels of water into this bag. The game also has a full-physics system, so you can move things around and they have weights and what have you. I found that you could put heavy things in this bag and then if you were to take that bag and put it in a box or something within the game world, that box would suddenly weigh thousands and thousands and thousands of kilograms. So I once beat an enemy I was stuck on by filling a box full of ridiculously heavy things and dropping it on his head. And instantly killed him."* – Male, 26 (Interview)

Other references included rocket jumping in FPS games, using the dying and respawning mechanic "strategically to because there is no penalty for dying" (male, 35, narrative survey) and using Redstone (building material) in Minecraft (Mojang, 2011) to create "entire working computers" (male, 28, interview).

In terms of the *glitches* category, participants mentioned using glitches for fun and for use in other activities such as speedrunning. In terms of using glitches for fun, most participants had read about the glitches in external resources (e.g. internet, magazines or heard about them from friends) and wanted to try them out themselves. The most common game cited in the study for using glitches for fun was the *Pokemon* games, especially *Pokemon Red and Blue* (Game Freak, 1996). Using glitches in this was not particularly linked with overcoming any specific challenges in the game, and instead mainly related to an exploration of what was capable within the game out of curiosity.

> *"We found a fairly notorious bug with a swing set where if you park a car on the middle bar of the swing set in a playground, the physics will bug out and it will launch the car miles into the air and we used to do shot put. So we'd each choose a car, line it up and see who could get the furthest across the map."* – Male, 26 (Interview)

Some participants did note, however, that they did not like to use glitches for fear of breaking the game and losing their saved data or because they felt it detracted from gaming experience as it was meant to be played.

> *"I haven't used or found glitches in the games that I've been playing – even if they have been prominently there, just because of self-awareness of what if it just breaks my game and I've lost all this progress."* – Male, 23 (Interview)

> *"I feel often with strategy games because ones I play are historical I'll tend not to use the glitches because it doesn't feel like it's the proper history but, you know, that's a personal preference thing."* – Female, 33 (Interview)

In terms of speedrunning, glitches were commonly used to bypass sections of the game. In this way glitches were used strategically in order to overcome player created challenges. Speedrunning is an example of altering the goal of a game to create an additional challenge which is not explicitly defined by developers and the use of glitches as strategy which is not foreseen by developers to be used to overcome this challenge. One participant cited using a glitch he found in the game *Strider* (Capcom & Double Helix Games, 2014) to bypass a large portion of the game and, hence, reduce his overall time for the speedrun.

> *"When climbing in Strider across the ceiling he has two hooks and we found that if at any point for a single frame one of those hooks goes between two parts of the ceiling that are at a 45-*

*degree angle to each other, you'll just, he has like a vaulting animation to get on top of ledges and the game freaks out, thinks you're on the other side and vaults you outside of the room. And so that is basically used to bypass two thirds of the game essentially and skip to the latter half."* – Male, 27 (Interview)

The *creating new challenges* category involved instances where participants a) either upped the difficulty of the game or used a playstyle they were not used to or b) deliberately played the game in a way not intended by the developers by adapting the rules. In the former, participants cited using the in-game difficulty scaling to create additional challenges for games they were already familiar with (i.e. had already played through at least once). Many games allow players the option to either lower or raise the difficulty either at the start of the game, or else at any point during it.

*"I'm stuck on Wolfenstein: The New Order which is one of my favourites, because it's also a really good example of storytelling even though it's about shooting Nazis. I decided because I'm an insane person, to try and beat it on the hardest difficulty, which I don't usually do. I usually stick games on normal and then I have no problem with changing them to easy if I'm enjoying the story but not enjoying the game. Because I definitely enjoy the story more than the gameplay. But for some reason, I decided to do it on the hardest difficulty just because I enjoy the game so much. And I was just stuck on one boss fight for about two days of near constant playing. And when I finally beat it, I'm really glad no one else was in the house. I'm glad it wasn't at 2 in the morning and everyone was asleep because I would have woken up the street, let alone everyone else here."* – Male, 26 (Interview)

While the majority of games allow players to set the difficulty of gameplay, participants also mentioned using mods to provide additional difficulty. Mods are game modifications which can be added to the game to provide additional functionality and challenges. Mods are usually created by the game community. Players who cited the use of mods had played the game first in the way the developers had intended (i.e. without mods) and were already very familiar with it. They sought the use of mods to bring additional life and replay value to the game.

*"I'm playing a lot of Minecraft at the moment, and I like to play Minecraft with mods to augment the experience. So most of the mods I'm playing at the moment make the game extremely difficult. So even just getting through the first tier of tools it becomes extremely difficult, and you have a good week of playing before you get to that first tier."* – Male, 28 (Interview)

In terms of creating new challenges by adapting the rules of the game, the most common example of this was speedrunning, where players intentionally altered the overall goal of the game to finish it as fast as possible. Playing the game in this way created additional challenges in the way the game needed to be played. Speedrunning is where the player attempts to complete a game in

as little time as possible, using skill, glitches, new uses for existing game mechanics or a combination of all three.

> *"I was doing speedrunning for about two years as well which is a lot of this sort of single player mentality, it's only me trying to get better and at the same time it's the same thing over and over, resetting the game hundreds of times to try and get the perfect run."* – Male, 27 (Interview)

In addition to completing the game as quickly as possible, one participant mentioned that some speedruns involved different goals. An example of this was the Chef% run in the game *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011):

> *"One recent example was I did a speedrun where instead of trying to beat the game, it's got a weird name; it's called Chef%. I don't know who names this stuff, but basically, it's a speedrun in which you try to collect a chef's hat and a chef's top and then try to make like some meatloaf thing and make like five meals as quickly as possible and then, even though you don't beat the game, you just stop the time when you've completed what is considered the Chef% run."* – Male, 36 (Interview)

It was also noted there were different types of speedrunning. This related to how the game rules had been adapted in terms of the overall goal of the speedrun. For instance, the goal of some speedruns was to do a completionist run where the speedrunner aimed to complete everything in the game, where in other speedruns the goal was just to finish the game in the shortest time possible. For each different rule adaption there were also rules in terms of what strategies could be used: for instance, in some speedrun types the use of glitches and exploits were permitted, where in others the player was expected to rely purely on skill.

> *"It largely depends on the speedrunner and what they use but in a, what's called an any%, that's where you're not necessarily using glitches, you basically try to either play the game as skilfully as possible using optimal strategies, you know, you're going to use the most powerful weapons you can or use the best tactics you can against certain enemies and things like that, deciding areas to skip, you know, because in any% or also a low%, you're not necessarily trying to get 100% of the game, you're just trying to get to the end credits as quickly as you can."* – Male, 36 (Interview)

Other instances of where participants had adapted the rules of the game included playing games in a competitive manner or creating a competition based on games which had originally been developed for single player use. This included games which had originally been designed with children in mind such as Pokemon and where "playing the game competitively is completely different [from playing normally] because it's all about mind games and getting into the head of your opponent" (male, 23, interview).

In conclusion, participants cited playing games and using strategies or techniques which had not been explicitly intended by developers to create their own unique gaming experience. Using games in this way related to the ways in which players adapted and incorporated games to suit their personal tastes and motivations for play. This included finding *new uses for existing game mechanics*, discovering and using *glitches* to overcome challenges or to test the boundaries of what the game would allow, and *creating new challenges* by increasing the difficulty, using mods or adapting the game rules to create additional goals.

#### 4.2.1.2.2 Discussion

*Creativity as appropriation* related to the ways in which players went above and beyond developer expectations. It has been suggested that appropriation and creativity go hand in hand, with appropriation being viewed as a creative process whereby what a technology affords in terms of possibilities of use encourages users to go beyond the intended boundaries, inventing and defining the user experience (Degele, 1997). According to Steinkuehler et al. (2012) the reworkings of games by players illuminate that aspects of culture are malleable and able to be interpreted in multiple different ways, and in some cases games are "made real" only through this engagement with the player base (Taylor, 2002).

*Creativity as appropriation* was cited in both open-world multiplayer games such as *Monster Hunter: World* (Capcom, 2018)*, World of Warcraft* (Blizzard Entertainment, 2004) and *Star Craft II* (Blizzard Entertainment, 2010) as well as open-world single player games such as *Grand Theft Auto IV* (Rockstar, 2008)*, Legend of Zelda: Breath of the Wild* (Nintendo, 2017) and *Skyrim* (Bethesda Game Studios, 2011). Appropriation in MMOGs was usually a social affair, with participants citing playing the game with real-life or online friends. This finding was in line with the Game Appropriation Model (GAM) (Herodotou, 2009; Herodotou et al., 2012) which states that open-ended, flexible game design, social praxis (e.g. reflection and action) and individual player characteristics are the main contributing factors to game appropriation. With single-player open-world games, participants also referenced adapting the rules of the game when playing with friends and family in co-located settings, although this was cited to a lesser extent than MMOGs.

While MMOGs and open-world games afford the player a variety of different possibilities, more structured games were also cited as being mediums in which players were able to express creativity. This was largely seen in the speedrunning examples participants gave whereby they were able to create a new goal for the game which was not intended by the developers. The various glitches, and strategies used for playing the game in this way were not referred to as "cheats", but instead tactics tailored towards the newly created goal. Consalvo (2009) argued that such "exploits" can be defined as "actions that are 'found' by players within the existing code of a game and appropriated towards succeeding at the game in new and often contentious ways"

(Jarrett, 2014, pp.4). Similarly, the use of such exploits or glitches in speedrunning could be seen as forms of transgressive play whereby players are able to "regain their sense of identity and uniqueness through the mechanisms of the game itself" (Aarseth, 2007, p. 132). Games cited for the speedrunning examples were less "open-world" and more structured in terms of how players were expected to progress through them. However, participants described ways around these restrictions in terms of using glitches to bypass areas, making use of existing game mechanics or, where the game allowed, playing the game in a different, more optimal order (in terms of game areas). While there exists no literature specifically on speedrunning, Jarrett (2014) examined the expression of creativity in MOBA games. MOBA games involve a highly structured form of play, leaving little in the way of possibilities for players. However, despite this, players were able to adapt existing game mechanics to create new, powerful attack sequences. These findings were similar to the references from two participants who regularly played *StarCraft II* (Blizzard Entertainment, 2010). They described the multiple ways a game could unfold, despite the map and factions being the same each time. Each experience was unique in terms of the particular combination of game variables such as placement of bases on the map. The creativity in both speedrunning and the case of adaptive play in highly structured games can be seen as emergent forms of play where rules can be combined and adapted to lead to variation of the play experience (Juul, 2002).

The level of structure in a game related heavily to the type of creative expression referenced by players. For example, in many MMOs participants referenced instances of creativity aligned with the *creativity as problem-solving* theme, whereas in more structured, less open-games, participants often mentioned instances of creativity from the appropriation perspective. This can be illustrated with Schäfer's (2011) distinction between implicit and explicit participation: in open-world games and MMOG's, implicit participation may be more likely. This type of creative expression is already within the constraints of the game, such as object creation in *Minecraft* or creating different outfits using armor in *Monster Hunter: World*. The affordances for these actions are already available to players, although the combination of these actions can be unintended. More restricted and structured games involve explicit participation, such as speedrunning whereby an entirely new goal is created through adaptation of the game's rules and involves the use of glitches and exploits which were never "built into the game". Explicit forms of participation are not only confined to altering things *within* the game but also encompass player created modifications and other external resources such as fanfiction. Several participants noted preferring to play games using mods, although, similar to those who replayed games on higher difficulties, those who played with mods had already played through the game as the developer had intended. In this way, players are able to go beyond the implied behaviour set out by developers by defining new ways to play.

Participants who cited creating additional challenges such as using mods which added more functionality or increasing the in-game difficulty had often already completed the game in question and were familiar with the original challenges. Those who deliberately increased the game difficulty to provide a new gaming challenge cited adopting different strategies and playstyles. Being creative in finding and creating new challenges when current ones no longer challenge the skill level of the player was a finding echoed in both Walker (2010) and Sorensen's (2007) studies which examined creativity and flow.

The sub-themes of *new use for existing game mechanics* and *creating new challenges* can be seen as emergent forms of play, however, the sub-theme of *glitches* involved curiosity as being the main motivational factor. Participants often cited wanting to "try out" glitches which they had often heard about from others. While participants also cited using glitches tactfully or to explore the boundaries of the game, those who cited using them for "fun" suggest that their actions were more an expression of curiosity than creativity due to there being no end goal or outcome in mind when using them. It has been argued that overcoming problems is inherent to creativity, where a "problem represents a gap between were we are or what we have, and a desired location or outcome" (Treffinger, Selby, & Isaksen, 2007, pp.1). In this regard, participants did not cite any problems they were trying to overcome by using glitches, and hence, were merely a source of "fun". Conversely, participants who were engaged in speedrunning cited using glitches in a more purposeful manner to finish the game as quickly as possible.

It is also worth noting that several participants felt strongly that using glitches detracted from the way a game was meant to be played, suggesting a dichotomy between using glitches in a non-serious way as opposed to using them as an exploit (Consalvo, 2009). This illustrates the shifting meaning of what is defined as acceptable forms of creativity within the game. For example, in the speedrunning community the use of glitches to bypass areas of the game is textbook behaviour in certain types of "runs". However, many players frown upon the use of exploits, considering them a form of cheating as they are not intended by developers (Jarrett, 2014). Several participants cited that older games were less "polished" and contained far more opportunities for exploit discovery, whereas newer games, especially MMOs are constantly being updated and patched to prevent players from such discoveries. It has been argued that modern games subscribe to an underlying ideology of "meritocracy" between players and developers, with developers constantly striving for a perfect balance of gaming variables (Paul, 2012). However, as participants had noted, the repeated attempts to maintain this meritocracy limits the opportunities for emergent play and other forms of player creativity. In this way, games where developers allow players to experiment and actively seek out exploits may foster creativity.

In conclusion, the expressivity of creativity in terms of appropriation sheds light on how players interpret and adapt their play experiences as well as how the expressivity of creativity bleeds into other areas of life. In this case, players are able to create external resources in the form of User Created Content (UCC) to either complement their gaming experience, such as the case of mods, or as an additional creative outlet to express their enjoyment of games.

#### 4.2.1.3 Creativity as Affective Change

This theme corresponded to instances where a player's beliefs or views were challenged or changed due to a game. This often involved reflection instigated by a game's narrative, which resulted in changes in a player's worldview or perception of themselves. In this way creativity was expressed by the unique interpretations of gameplay and/or game narrative or through the challenging and subsequent accommodation of beliefs. In this way, what counts as creative for one individual may not count for another and is dependent on the participant's existing beliefs and identity. This theme was refined into six sub-themes as shown in table 11.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Affective Change | Personal | This theme explored references to changing or challenging opinions about oneself and one's abilities (e.g. realising that they could succeed at something they had otherwise believed they were not good at) and encompassed all emotional connections with a game's narrative and characters (e.g. feeling empathy with an in-game character due to experiencing a similar circumstance or set of issues in the past). |
| | Moral | This pertained to the changing or challenging of beliefs and views associated with moral issues such as right and wrong, good or evil, religion and gender equality. |
| | Games | This theme encompassed changes in the way players viewed games in general. Examples of this could be games which utilised new mechanics or storytelling methods which players had never seen before. |
| | Cultural | This theme relates to instances where a participant's cultural views have been changed or they have come to regard other cultures in a new light. |
| | Existential | This theme related to wider existential matters concerning humanity, existence and philosophical dilemmas |

*Table 11: Affective Change Sub-Theme Descriptors*

#### 4.2.1.3.1 Findings

The most frequently occurring sub-theme was *personal*. This theme included instances where participants spoke about the way games had influenced their perception of themselves including their hobbies, how they felt about their capabilities as gamers, and their identity.

> *"I would say it changes your personality first to begin with in terms of it makes you more observant in terms of what you can develop, the characteristics of an individual. You become more aware to personal experiences and personal situations."* – Male, 28 (Interview)

The above two excerpts depict the ability of games to give insight into the personalities of the player. Games which allow the freedom of choice in terms of dialogue options such as *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) or *Mass Effect* (Bioware, 2007) enable players to explore aspects of their personality that otherwise they may not have been given cause to analyse. Another example of this was the instance where a player deliberately chose actions which they usually wouldn't and as a result it ended up clashing with their personality.

> *"I tried to play a renegade character in Mass Effect. It didn't work, I can't bring myself to be that type of person even though it's not real."* – Female, 21 (Narrative Survey)

These types of games often present players with difficult moral choices where there is no clear distinction between right or wrong answers, or every option has negative consequences. In this way players are forced to pick "choices that you wouldn't pick at all [and] it kind of lets you know a little bit about what kind of a person you are" (male, 32, interview). In addition to highlighting important moral issues (see *moral* sub-theme), players may also be made aware of the difficulty and discomfort of being presented with such choices.

> *"I think it was Wolfenstein, where you're forced to actually pick somebody to kill. I don't know if that gives me a new perspective; it's one of those things that made me uncomfortable though in terms of being forced to do something that I don't want to do, that I don't usually do in games. I always try and find a way out of making those sorts of decisions, and it forces you into a particular path."* - Female, 52 (Interview)

In addition to the choices which some games may present, participants also noted instances where games had changed their views regarding competition, winning and failure. The ability of games to allow limitless chances to take on difficult challenges and experiment with different strategies allows players to "come to terms with being bad at something at the start" (male, 23, interview) and get used to the fact that "you will always make mistake [and] it's how you use that experience" (male, 34, interview).

Other references in the *personal* sub-theme involved participants talking about how a game's narrative, especially concerning the characters involved, elicited strong feelings and

empathy. Through relating to characters and narrative "it can actually raise your awareness of different types of people, different conditions and things like that" (female, 31, interview). Games cited in this sub-theme included *Metal Gear Solid 3: Snake Eater* (Konami, 2004), *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015), *Life is Strange* (DONTNOD Entertainment, 2015), *Life is Strange: Before the Storm* (Deck Nine, 2017)*, The Last of Us* (Naughty Dog, 2013) and *Portal* (Valve, 2007). Similar to the *moral* category, participants cited experiencing both positive and negative feelings surrounding the games narrative and characters.

> *"[In the Witcher 3: Wild Hunt] the Baron…had beat his wife and the kid went off, and then it was the miscarriage, and so they were talking about that, and I'd never seen anything like that. So it turned into this thing, but it was really sad in a lot of ways. And then just, it's kind of real emotions that are going on. And then you can kind of contribute to it, but usually it's like if it's extended cut scenes, and it's a lot of talking I tend not to be engaged. But this was fairly engaging story. And it puts you in at exactly the right time to be part of that."* – Female, 53 (Interview)

The second most frequently occurring sub-theme in the *Affective Change* category was *moral*. This involved games which either presented players with difficult moral choices, or the narrative of the game depicted morally charged themes such as slavery, war, ethnic discrimination and religion. The choices presented to players often elicited negative feelings such as sadness, shock and betrayal. An example from one participant who spoke about his time playing the game *This War of Mine* (11 Bit Studios, 2014) which presents a different perspective of war.

> *"It's fantastic but it's awful because it makes you feel things, like consider things that you didn't really have to think about previously. And it helps you think about how people can - the things that you have to do to survive and then obviously, it makes you feel bad. It's like, dude, this is actually a really bad decision and this is actually a really hard time. And you understand what many people had to go through."* – Male, 30 (Interview)

In terms of games which present difficult choices, and example was given by one participant citing the game *NieR: Automata* (PlatinumGames, 2017) where he had to choose between keeping his saved game data or helping other players defeat enemies.

> *"It says do you want to accept help. And it'll ask you that a few times. And eventually, you'll say yes because it's impossible to do it otherwise…it will bring in other people that have played the game as extra ships to help you shoot the credits. And then once you've beaten the credits, it says do you want to help other people in the same way that they helped you. And then if you say yes, it says to do this we will delete your saved data for the whole thing."* – Male, 26 (Interview)

The same participant also cited that this was the first game he had played which presented this kind of decision, and how the story of the game could not be told in another medium due to the level of player interactivity required in making such choices. Other references included participants talking about how games had provoked them to think in non-linear terms about good and bad where games presented scenarios and choices relating to themes such as religion, fake news, surveillance and gender. Referencing RPGs in particular, one participant remarked that:

> *"There is always a better solution and your character can always provide it and so I wonder if RPGs are able to give people that kind of belief system where they can always search for a better way"* – Male, 23 (Interview)

The sub-theme of *games* depicted participants' perceptions of games in general changing as a result of a new gaming experience. This included games which "broke the mould" (female, 28, Interview) in terms of the level of interactivity afforded to players such as *Legend of Zelda: Breath of the Wild* (Nintendo, 2017), games which provided a significant challenge, forcing the player to step back and realise not all games were easy such as *Monster Hunter: World* (Capcom, 2018) and games which utilised new ways of problem-solving in quests which blended the game with the real world such as *The Secret World: Legends* (Funcom, 2017). One participant cited the example of VR games which opened up his mind to what the future of gaming would be like.

> *"When I experienced how VR feels, I almost cried. It was like being inside the Matrix. It was so important to me. My girlfriend was like OK, calm down. I was like no, you don't understand this. This is the future. And it moved me because I saw the future and I saw how gaming's going to be. And people won't want to come back. It's just incredible."* – Male, 30 (Interview)

The *cultural* sub-theme included references to games which broadened or changed cultural beliefs. Examples included an instance where a participant played online with players warring countries or where the game's narrative (albeit in a fantasy setting) reminded the player of the immigrant crisis in Europe. Also included were games which specifically incorporated real world cultural history such as *Civilisation VI* (Fraxis & Aspyr, 2016) and *Never Alone* (Upper One Games, 2014).

> *"Our main healer was a Russian woman and one of our main DPS was a Ukrainian guy. And it happened at the exact time that Russia had invaded the Ukraine and that all this war was kicking off and I thought oh this is going to be so awkward. And we went online and these guys were just chatting away and everything was fine, you know, still just like best friends. And I remember sitting there and almost seeing a more human side to the whole thing that made me view the conflict differently than when I was seeing it on the news where it almost felt like entire nations were at war with each other. I wouldn't have looked at the situation more broadly if it hadn't have been for my experience with those people online."* - Male, 32 (Interview)

The final sub-theme *existential* referenced instances where participants' views on existence and humanity were challenged or changed. Examples included the game *SOMA* (Frictional Games, 2015) which tackled the idea of self and consciousness "presenting some very interesting arguments on both sides" (male, 26, interview), *Final Fantasy VII* (Squaresoft, 1997) which tackles the real world issue of global warming, and *Fallout 4* (Bethesda Game Studios, 2015) which tackles the idea of whether synthetics and zombies should be considered human.

> *"Fallout 4…This really called into question the concept of humanity. The whole game theorises the idea of whether synthetics and 'zombies' can be seen as human and this really questioned my ideologies on what makes someone human*." – Female, 30 (Narrative Survey)

In essence, the *Creativity as Affective Change* theme aimed to encapsulate the way in which games are able to act as a catalyst for personal, moral or cultural change in perceptions. Additionally, games are able to provide a medium in which players can relate to different types of characters; providing an insight into different lives as well as promoting new ways to think about the world around them and everyday problems. While the novel interpretations by participants were deemed as expressions of creativity, it should also be noted that this was often coupled with learning new facts and knowledge. This was particularly seen in the case of where participants were introduced to new cultures and game genres.

#### 4.2.1.3.2 Discussion

In *creativity as affective change* participants noted the ways in which games allowed them to view themselves and the world from different perspectives. The expression of creativity in this way is synonymous with the notion of Mini C creativity which refers to the "novel and personally meaningful interpretation of experiences, actions and events" (Kaufman & Beghetto, 2009, p. 3). The Vygotskian notion of cognitive and creative development claims that all individuals have creative potential through the "internalization or appropriation of cultural tools and social interaction" (Moran & John-Steiner, 2003, p. 63). This internalization and appropriation does not simply involve mimicking; instead the individual is able to reorganise and transform information and mental structures based on their own characteristics and pre-existing knowledge. As such it can be suggested that Mini C creativity occurs through the fluid and interpretive process of creating personal knowledge within a particular milieu. In this way, creativity in games can be argued to be expressed in terms of a player's reflection on the game's narrative and, as a result, the alteration of thought patterns, beliefs and perspectives. This can be likened to the process of accommodation which involves the altering of an individual's personal interpretive frame when it is challenged by contradictory information (von Glasersfeld, 1995). Mention of this reflection and

accommodation in this study was also not confined solely to larger world issues, but also included participant's beliefs about themselves and their own identity.

These unique changes in perceptions and identity could be seen as an outcome of the emotional challenges some games provide (Bartsch & Hartmann, 2017; Cole et al., 2015; Denisova et al., 2017). Emotional challenges "confront the player with emotionally salient material or the use of strong characters, and a captivating story" (Denisova et al., 2017, p. 2513). Cole et al. (2015) argued the main types of challenges in games are functional and emotional. Functional challenges are overcome with cognitive or physical skills such as problem-solving or dexterity and usually relate to a sense of achievement, power, enjoyment and skill development. Emotional challenges, however, cannot be overcome by conventional means and involve "resolving tensions built up by the narrative, identification with characters and the emotional exploration of ambiguity and solitude" (Bopp et al., 2018, p. 2). These emotional challenges invoke a reflective state in players and a wider range of emotions. Players who cited games which posed emotional challenges and subsequently, resulted in their own affective change, often recounted the experiences as being highly valued and enjoyable due to the feelings they elicited and how it made them "question" things. It is worth noting that not all these feeling were positive, and many participants cited feelings of sadness, shock and betrayal. This finding was similar to Bopp et al.'s. (2018) study which looked at emotional challenge in games, finding that feelings of anger, fear, sadness and tension were associated with the emotional challenge of games which present the player with difficult decisions such as *Life is Strange* (DONTNOD Entertainment, 2015), *Mass Effect 2* (Bioware, 2010) and *Papers Please* (3909 LLC, 2013).

Similarly, Bopp et al. (2018) found that games which presented players with difficult and existential themes were particularly challenging to players who had been in similar situations themselves (Bopp et al., 2018). This finding related to the sub-theme of *personal* where participants recounted instances where they felt a particular connection to a game character due to being in a similar situation themselves, and as a result were able to gain meaningful insights into both themselves and others. Bopp et al. found that by confronting difficult themes players were able to derive personally meaningful insights; a finding which again is in line with the Mini C notion of creativity (Kaufman & Beghetto, 2009).

The role that the game's narrative plays in affective change is especially evident in open world games and MMOGS which afford players numerous possibilities (see *Design Affordances* theme) in terms of the game's narrative, play style and avatar creation. Due to the countless choices and options, players are able to form their own subjective stories based on their game experiences. Calleja (2011) argued in his Player Involvement Model that narrative involvement in a game comprises not only of the "designed narrative"; the game world's history, background and

stories, but also the "personal narrative" of the player. The personal narrative is made up of an accumulation of game-play experiences as well as how the player uniquely interprets the game world (Calleja, 2011). In line with this, Banks (2013) found that players of the online open-world game *World of Warcraft* actively construct headcanons or idosyncratic stories relating to their personal narrative, including "speculations about how their character may be affected at the cognitive, behavioral, and emotional level by the relationship between player and avatar" (Bowman et al., 2015, p. 51). This is something which was highlighted by one participant in the current study who, referring to the open-world game *The Elder Scrolls V: Skyrim,* spoke about an area with a trophy which was blocked off by a wall of fire. One of the characteristics of the persona he had created for his character was that he was afraid of fire, and so, for years he put off getting the trophy as it would affect his character's own narrative within the game.

The personal narratives and experiences of players can lead to learning on a personal level such as emotional development, cultural development and changing as a person (Iacovides et al., 2014). The construction of a personal narrative which invoked affective change in the player can be illustrated by Lee and Hoadley's (2007) study which found that through experimenting with different identities players were able to solve problems from the viewpoint of the roles they took, as well as gaining new perspectives and challenging them to think in different ways. Similarly, in the current study, participants who cited instances of affective change in terms of *cultural* and *games* were able to gain new knowledge about different cultures and the different uses for games through reflection and accommodation. Additionally, the sub-theme of *games* where participants referenced instances where games had prompted them to change their perceptions of gameplay or what was possible in games is reflective of endo-transformative reflection (Whitby et al., 2019). Endo-transformative reflection is where players experience affective change which is limited to the game or gameplay, such as was illustrated by one participant who recounted her experience of *The Legend of Zelda: Breath of the Wild* (Nintendo, 2017) as prompting changes in what she believed was possible in gameplay.

In essence, it can be suggested that through the game's narrative, along with the affordance for different possibilities, players are able to form personally meaningful and novel interpretations of the world. These findings may begin to answer the question posed by Bowman et al. (2015) in their review on creativity and digital games which called for research to examine the association between content-specific differences in games (e.g. games which are light and enjoyable vs. somber and meaningful) and the different emotional and cognitive responses of players and the creative outcomes they related to. Games which relied heavily on narrative and the role of the game's characters in this narrative such as *Life is Strange* (DONTNOD Entertainment, 2015) allowed participants to reflect on instances in their own lives similar to that of the games characters. Additionally, many participants cited the gameplay itself as a means of

allowing them to discover “what type of person” they are and become more aware of their capabilities as gamers.

### 4.2.2 Player Conceptualisations of Creativity

All participants explicitly indicated that they thought games involved creativity in some form. In relation to *RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?* there emerged three distinct conceptualisations: *ways of thinking, constructing in games* and *games as an artform*.

*Player Conceptualisations* of creativity related to the explicit ways in which players viewed what it means to be creative in digital games. See table 12 for an overview.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Player Conceptualisations | Ways of Thinking | Creativity in games is conceptualised as the creative ways of thinking games promote. |
| | Constructing in Games | In this conceptualisation, creativity in games was viewed as the creation of actual game content such as building castles in Minecraft or creating levels using a included level editors. |
| | Games as an Artform | Creativity in relation to games is viewed mainly from the standpoint of the developers. In this way games are viewed in a similar light to other creative mediums such as film and writing and require a similar level of creative input from developers. |

*Table 12: Player Conceptualisations of Creativity Theme Descriptors*

#### 4.2.2.1 Ways of Thinking

##### 4.2.2.1.1 Findings

The most common perspective of creativity in games was *ways of thinking* which referred to the more general thinking which games promoted such as thinking of alternative solutions to challenges and “exercising that part of your brain that makes you think outside of the confines of what’s in front of you” (male, 26, interview). The viewpoint that creativity in games is expressed in terms of “out of box thinking” was linked with the *creativity as problem-solving* theme which referenced the ways in which players were able to invent strategies as well as their approaches to overcome difficult challenges.

Participants who cited creativity as being aligned to this theme also noted how games encouraged players to test the boundaries of what the game mechanics would allow, a perspective which aligned with the theme of *creativity as appropriation.* This included some participants mentioning the creativity involved in finding glitches and exploits, however, this was noted to be more difficult now as games had become more polished upon release.

> *"If anything, playing games is my creative outlet and my only creative outlet! And that's both, like video games and board games or paper type games or whatever. For me my creative outlet is gaming because it's the language I'm familiar with. There are rules, constraints, but what you can do within those rules and constraints kind of define how far you can go and where you can push yourself."* – Male, 23 (Interview)

> *"Generally more like early in development games are good because they have a lot of bugs and such that are not intended. So you can use them to your advantage in creative ways."* – Female, 21 (Interview)

*Ways of thinking* was referenced across a range of different game genres suggesting a more generalized conceptualization of player creativity that is not necessarily confined to any particular type of game.

#### 4.2.2.1.2 Discussion

In *ways of thinking*, creativity was viewed as the creation of novel solutions to problems and challenges. Participants cited that games allow players to make choices, experiment and discover aspects of the game and these actions facilitate the ability to "think outside the box". This conceptualisation of creativity was connected to the expressivity of creativity as problem-solving and in-game appropriation, whereby players were able to experiment with game variables, discover new strategies, find the optimal way of approaching problems and create new ways of playing the game. Being able to think outside the confines of everyday life also suggests a correlation with creativity as affective change, in terms of the altercation of the player's cognitive processes and outlook. This could be argued to provide greater cognitive flexibility and decrease "functional fixedness" (Bransford & Stein, 1993) where players are confined to their own routine problem solving strategies and are unable to identify unusual problem features (Simon, 1969). Having greater cognitive flexibility allow individuals to be more observant in terms of problems and able to consider alternative solutions (Bransford & Stein, 1993).

This conceptualisation of creativity in terms of being able to think outside of normal confines is compatible with both Little C and Mini C approaches. In the former, creativity is conceptualised as the application of everyday creativity to overcome and solve problems (Richards et al., 1988). Little C approaches such as Richards et al.'s (1988) *everday* creativity and Maslow's (1968) *self-actualizing* creativity, argue that everyone has creative ability to some

extent, and this ability can be developed further. The capability of games to alter players' worldview and ways of thinking about everyday problems could be seen as a type of affective change, synonymous with the Mini C approach (Kaufman & Beghetto, 2009). In this way, creativity in games is conceptualised in terms of the novel and personally meaningful interpretation of the gaming experience, and how this interpretation transfers to other aspects of life such as solving everyday problems.

#### 4.2.2.2 Constructing in Games

##### 4.2.2.2.1 Findings

Another perspective which participants held was *constructing in games* where creativity in games was conceptualised in terms of creating game content. This was usually in reference to sandbox style games such as *Minecraft* (Mojang, 2011).

> *"You can make anything you want in Cities Skylines and Kerbal Space Agency."* – Male, 32 (Narrative Survey)

> *"It depends on the game - sandbox games like Minecraft can be very creative because they are open-ended and leave plenty of scope for the player."* – Female, 58 (Narrative Survey)

Several participants also talked about creating levels and maps using integrated level editors as a way to try out game design and "improve on what's available" (male, 54, narrative survey), although they hadn't spent a great deal of time on these activities and it was more for "fun" (male, 34, interview). Additionally, while a number of participants mentioned using mods (modifications which add custom items, levels, characters, objects and interfaces) created by third-parties to add further functionality or items to their games, some participants mentioned creating such mods themselves using in-game mod editors and toolboxes. One participant stated how he enjoyed adding mods to *Minecraft* (Mojang, 2011) which turned building things into an automated process:

> *"I enjoy modding it, so adding things that weren't in there originally. And I am fascinated by automation systems, so I'll have mods that allow me to instead of building my own stuff, I'll start a factory that will build the stuff for me…I like the idea of building a system and then making it more efficient and all that sort of thing. And I found a way in one modification that added solar power. I managed to break it slightly and instead of using solar panels, I managed to create my own sun."* – Male, 26 (Interview)

In this way, in addition to creating in game-objects and using level editors, the use of third-party modifications can add additional functionality. It also provided a means for *creativity as appropriation* whereby players can pick and choose what aspects of the base game they wish

to customise. In the example above, not only did the participant implement a modification allowing him to use solar power (something which was not already in the game), he also found a new use for the modification in terms of managing to create his "own sun".

Many participants referenced creating objects and implementing mods, however, only one participant, who was a game developer by trade, mentioned creating his own games from scratch.

> *"So for a while I have been working on a game engine to make point and click adventure games for example. So I have an idea of how point and click adventure games works because I've played a bunch of them. It's like OK I need [this], this is how I structure it, and here is how I'm going to make it. And it was very Broken Sword inspired, very Monkey Island inspired sort of thing."* – Male, 28 (Interview)

While level editors and the inclusion of developer implemented building systems allow those who do not have a significant amount of game development knowledge to be creative, the participant who was a game developer was able to take this further by creating his own games based on previous games he enjoyed.

#### 4.2.2.2.2 Discussion

*Constructing in games* involved the creation of in-game content. This conceptualisation was usually cited with references to sandbox style games such as *Minecraft* (Mojang, 2011) and games which included content creation editors. Going back to Burri's (2011) levels of User Created Content (UCC), this conceptualisation is synonymous with games which fall under the category with the greatest scope for UCC. In games such as these, players are able to shape, define and personalise most aspects of the game as well as share created content with other players. Through providing flexibility in terms of the design of the game, the creation of game content by players could be seen as a way in which players are able to innovate and personalise their gaming experience. This aspect is illustrated in the Game Appropriation Model (GAM) (Herodotou, 2009; Herodotou et al., 2012), under the characteristic of flexibility which states that games with paidaic structures which are open to player created content allow for greater creativity and personalisation.

In relation to existing conceptualisations of creativity, *constructing in games* can be likened to the conceptualisation of creativity as a product, where creativity is defined as the ability to produce something which is novel and appropriate (or useful e.g. Ochse, 1990; Sternberg, 1988). Several participants talked about creating levels and maps as a way to "make interesting levels" and do things they hadn't seen in games before, although they hadn't spent a great deal of time on these activities and it was more for "fun". This type of experimentation is synonymous with Little C approaches, which include everyday creative activities which the

average person is able to participate in (Richards, 1990). Games which provide level editors and map creation software could be argued to support this type of creativity by providing players with the opportunity to pursue their curiosity and dabble in elements of game design.

Other examples of this type of creativity could be illustrated by instances where participants mentioned creating in-game items and buildings in sandbox games such as *Minecraft* (Mojang, 2011) and *Planet Coaster* (Frontier Developments, 2016). Unlike instances where participants had mentioned using level and map editors, the creation of in-game content in sandbox games was portrayed as a more serious activity as opposed to a form of exploration. Participants mentioned spending more time creating in-game content, as well as planning in advance what they were going to create.

The focus on the creation of in-game content may highlight important aspects of the creative process, as well as the possible distinction between play versus creativity. It has been argued that the difference between play and creativity is that play encompasses a set of behaviours, whereas creativity involves a distinctive process (Stebbins, 2015). The examples where participants spoke about using level editors in a non-serious, "fun" way could be related more to an initial, explorative play state. It has been suggested that play promotes combinatorial flexibility, the opportunity to recombine existing behaviours and combine ideas in novel ways which initially may not seem entirely useful (Amabile, 1996; Weick, 1979). In this way, the "non-serious, fun" play could act as the building blocks for further creative action.

While all other examples fell under the Little C category when it came to the creation of game content, one participant who was a game developer himself mentioned creating his own games from scratch. He indicated he was very active in the game development community and was working on creating his own game engine for point and click adventure games. As opposed to creating content with what is provided by game developers, the creation of games from scratch could be viewed as a shift from Little C creative output to Pro C (Kaufman & Beghetto, 2009) creative output whereby the creativity is beyond everyday innovation but not yet reached eminent Big C creative status. Similar to those who were not game developers by trade, the participant who was a game developer also spoke about planning, structuring and refining his ideas, hinting that the overall creative processes were similar.

#### 4.2.2.3 Games as an Artform

##### 4.2.2.3.1 Findings

Conceptualising creativity in terms of *ways of thinking* and *constructing in games* was predominantly viewed from a player's perspective (i.e. creativity was on the side of those who

play games), in *games as an artform* participants expressed that creativity was viewed largely from a development standpoint (i.e. creativity was on the side of those who create games). Similar to the level of creativity which goes into other forms of media, participants viewed games as a creative medium in and of itself. In this respect, creativity was largely down to those who designed and developed the games.

> *"Video games are definitely an outlet for creativity as far as I'm concerned both like making and playing. I'm very much in the camp that video games are an art form."* – Male, 23 (Interview)

> *"They take skill to write and create. Games have stories just like movies or books. They require a similar level of directing."* – Female, 21 (Narrative Survey)

While all perspectives capture unique aspects of what it means to be creative in games, the majority of participants cited multiple views of creativity, suggesting that these three conceptualisations may be inherently linked. Participants also cited that creativity from games was able to transfer to other areas of life and vice versa (also see *Transferability: Ideas*), with participants suggesting that creativity is like a skill in itself which can be increased through creative play.

> *"I do think that creativity sort of breeds creativity, you know. It's difficult to say because I'm quite creative. I do a lot of writing as well as my study writing that I do. I also do some fictional writing. I also just learned songwriting, guitar. It's hard to say if I would be as creative there if I wasn't also being creative in games because I've always been doing that in games since I was 12 or 13, so I've never taken one away."* – Male, 32 (Interview)

> *"I kind of think creativity's kind of like a muscle: the more you use it the better you'll get at it. So, a chance to use it in games means you're more likely to be creative outside of them, I guess."* – Male, 21 (Interview)

> *"I feel it's rather the other way around. Being creative and thinking critically in life allows me to do the same in games."* – Male, 27 (Narrative Survey)

In total, three distinct conceptualisations of creativity emerged from the interview and narrative survey data. Firstly, creativity could be viewed as *ways of thinking* involving unique play experiences brought about by finding novel ways to do things, test the boundaries of the game and adapt gameplay. Secondly, creativity was conceptualised from a more traditional product standpoint in terms of the creation of in-game content such as building cities in *Minecraft* (Mojang, 2011), using level editors to create game content or implementing modifications to add further functionality. Finally, creativity was viewed from the developer's side in terms of *games as an artform* similar to other creative mediums such as art and fiction. Additionally, it appeared that creativity was not said to be confined to the medium of games, but instead, appeared to be

transferrable to other areas of life, or from other areas of life to the game.

#### 4.2.2.3.2 Discussion

*Games as an artform* related to the creativity involved in the development and design of digital games. The view that games are art is becoming more widely accepted with many games now being enshrined as art forms in their own right (Bogost, 2011; Clarke & Mitchell, 2007; Smithsonian Institute, 2012). This conceptualisation is more in line with Big C approaches which view creativity as the creative outcomes of someone who is highly competent in their given domain such as Noble prize winners, great authors or famous artists who have all mastered skills in their particular domain (Csikszentmihalyi, 1996). In this way, games were viewed in line with other creative works such as artwork and films.

Counter positioning the creative works of players within the game against the creative works of the game developers also hints at a distinction between "amateur" and "professional" creative labour. In this way, players who cited conceptualisations in the *constructing in games* category referenced works of amateur creative labour in that they were doing it intrinsically and for their own enjoyment and exploration of their creative abilities. Inversely, the conceptualisation of games as artforms hints at Big C creativity and subsequently professional creative labour. According to Lastowka (2012), professional creative labour has commercial value and is packaged and sold within the industry – in this case, the games industry.

While this conceptualisation suggests that the creativity is on the developers' side, a few participants did mention that games require creativity from both developers and players. It has been suggested that digital games are examples of co-authorship between developers and players, requiring input from both in order to be fully finished products (Bowman et al., 2015). Examples of this could be illustrated by instances where developers have incorporated player modifications into their games or created new products inspired by things players have created – such as the MOBA game *Defense of the Ancients (DoTA)* (Eul et al., 2003) which was originally created as a modification by players for the game *Warcraft III* (Blizzard Entertainment, 2002). *DoTA* defined the MOBA genre in gaming and eventually, the developer Riot Games, along with several prominent community members involved with the creation of *DoTA* went on to release the commercialised *League of Legends* in 2009 (Jarrett, 2016). In this way, the creation of these games would not have been possible were it not for the ingenuity of the player base which created the original modification for *Warcraft III*.

### 4.2.3 Learning from Creativity

*Learning* was related to instances where learning had occurred as a result of being creative in games. Most participants did not use games as explicit learning tools, however, were still able to reflect on the particular learning benefits which gameplay provided. Table 13 gives an overview of the main learning categories which were identified.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Learning | Cognitive | This related to cognitive skills such as problem-solving and mental dexterity. |
| | Game Specific | This related to game specific skills such as learning and memorising controls, memorising enemy attack patterns and learning to read the in-game map. |
| | History and Culture | This theme related to learning facts about historical events or different cultures. |
| | Social | This related to developing socially orientated skills such as negotiation, teamworking, mentoring and communication. |
| | Music | This related to gaining compositional knowledge from in-game music. |
| | Literacy | This involved learning the meaning of different words as well as different languages. |
| | Motor | This related to the development of motor skills such as manual dexterity and hand-eye coordination. |

*Table 13: Learning Sub-Theme Descriptors*

#### 4.2.3.1 Findings

In the *cognitive* category, participants predominantly noted problem-solving and mental dexterity to be the main cognitive skills developed from engaging in gameplay. Usually, this was mentioned in relation to the ability of games to promote divergent thinking patterns such as considering alternative solutions or strategies.

> *"The other thing with gaming is that, I suppose in terms of speedrunning, what I've gained other than, you know, something monetary, is the ability to make quick decisions in an environment that is ever changing."* - Male, 36 (Interview)

> *"The games I play help me to keep my brain nimble and active."* – Female, 63 (Narrative Survey)

In addition to problem-solving and mental dexterity, other cognitive skills mentioned included reasoning, working out patterns and the connection of abstract concepts. Additionally, one participant mentioned using games as a form of mental exercise before a difficult real-life situation.

*"If I have an important interview for example, I would like get up early, like as in preparation and like get ready and stuff, but I would also play a short game of Star Craft II just for some kind of mental exercise. Or if it's like an important day at work or something or will be stressful, I would also kind of do that same sort of warmup. I don't know it just helps because at some point it's even like if I prepare for work or if I play one of the games, it kind of has the same effect."* – Male, 28 (Interview)

The reference above was the only instance where a participant mentioned using a game as an explicit learning tool for a particular goal. In this instance, the goal was mental preparation for a difficult day. The majority of references were mentioned in relation to the cognitive skills gained from digital games in general, and did not pertain to any specific instances of gameplay, or any particular learning goal.

*Game specific* skills related to those which allowed the player to progress and develop in the game. Game specific skills included learning controls, learning different ways of doing things and learning attack patterns.

*"I feel I gain…Knowledge and skill to play the game well. I'm learning controls and learning about the characters and the world. It was also a lot of fun."* – Male, 35 (Narrative Survey)

*"I watch on YouTube, there's a guy who shows me, or I watch a guy and it's just passive. It's like I'm just watching him play the game it's like OK the monster's doing that, I suppose I could; it's like subconsciously learning it. And then there's also going in and doing it yourself and learning it that way. Because the way I do it, I may find better than the way he's doing it. So it's just, it's a mix of both, you know, learning from someone else and learning from doing it yourself. Almost like you do learn in everyday life I suppose."* – Male, 19 (Interview)

The learning of game specific skills usually came about through a) the use of external resources such as YouTube videos, guides and tips from friends and b) reflective practice inside the game. In the latter the player would learn through practice and occasionally trial and error approaches. This way of learning was especially evident in speedrunning examples, where participants talked about timing and recording their gameplay sessions in order to identify areas for improvement on playback.

*"When I was learning games like Bastion where there was a large community around it, you've got hundreds and hundreds of videos to study, so it would be a case of watching say, the world record, seeing what they're doing, watching 30 seconds of it, hitting pause, trying to emulate it, do that a couple of times, then do the next one and the next bit and then scale it up, so OK, right, I'll do the entire level now, do that and then eventually you do every level and then you go, right, I'm going to sit down and do a full run regardless how long it takes me. I'm just going to sit here and do the full run, record all of my times, and then you basically can either watch it*

*back or you can just go again and you'll see, you get rewarded essentially immediately."* – Male, 27 (Interview)

*History and culture* related to instances where players had learnt facts about history or other cultures. Two participants were already interested in history and specifically picked games which were historically accurate, however, the majority who referenced learning facts about history and culture did not a have a pre-existing interest. Often participants cited games as inspiring them to then go and learn more about certain time periods.

*"Europa Universalis 4…The game is set in Europe (mostly) between 1444 and 1850 - a period of history I previously knew very little about. Through playing the game I have been inspired to learn more about early modern European history."* – Male, 30 (Narrative Survey)

One participant who had a pre-existing interest in history, mentioned that it was through playing video games as a child which had inspired him to then go on to study history.

*"It [Dynasty Warriors] was a silly fighting game really, but it focused on a period of Chinese history that was just fascinating. And I ended up going off to university and studying that period because the game had inspired me to do that. And then again, my interest in mythology in the last five years in Greece and Rome was really inspired by the Elder Scrolls games and the, just the really rich mythology that existed in those worlds with their Gods."* – Male, 32 (Interview)

*Social* related to socially orientated skills including teamworking, communication and negotiation. Participants mentioned gaining communication skills through communicating with other players from online gaming communities such as *Monster Hunter: World* (Capcom, 2018) and *World of Warcraft* (Blizzard Entertainment, 2004).

*"Part of the joy in one sense is that you do it with friends and so what you learn from, or not necessarily friends, but people you meet online. But what arises from that is this self-supportive community that teaches each other things about how to play the game. So, a lot of what you actually end up learning whilst playing Monster Hunter is just firstly, knowing how to work together efficiently with people."* – Male, 27 (Interview)

Through communicating with other players during gameplay, participants were not only able to gain important communication and teamworking skills, but also how to successfully mentor and guide newer players. While this happened to a degree *outside* the game in terms of discussions with friends and on gaming forums, this type of mentoring was especially evident in online games such as *World of Warcraft* and *Monster Hunter: World*.

*"I'd be playing this game [Monster Hunter] on the Wii U, before this one came out, and a guy just then on the PS4 sent me a message was like hey, can you help me, I'm struggling. And mind you I was busy I couldn't help him. It was me and my friend going through it. I was able to tell*

*him, there's this Facebook group, go join it, guys are really friendly, they'll tell you what to do, they'll help you. And it's like a domino effect. You're nice to someone else and they're nice to another person in turn. It's just a very tight knit community that everyone enjoys being in."* – Male, 19 (Interview)

Additionally, participants mentioned having leadership roles which involved both guiding and managing larger teams of players. These roles came with a high level of responsibility as the player had to read up on strategies the group could use beforehand.

*"It's the first big team leadership role that I've ever really had. In my professional life I've always worked in teams but I've never been a team leader or anything, like never been in a management position or something along those lines, so when I was asked to do this after the previous leader left, it was honestly the challenge of it to try and keep people engaged and keep everybody on track and I like to think personally that since I took over that we've got better, at least from my understanding of before I was in charge, so to speak."* – Male, 27 (Interview)

*Music* related to instances where participants mentioned gaining knowledge and ideas for composing music from the game. It is worth noting, however, in the instance of this study that the majority of participants were already engaged in other creative pursuits (e.g. playing musical instruments) and were possibly more aware of learning in this area as a result. All cited instances of learning regarding music were referenced by interview participants. Participants mentioned deconstructing the game music and identifying the different instruments involved. Analysing the music in this way allowed participants to identify pieces which they felt could be replicated outside the game, integrated into their own compositions, or provide them with ideas for new pieces.

*"I've kind of learned little bits and pieces of composition from gaming. Like through listening to the soundtracks and kind of picking out "ok that instrument is doing that, that instrument is doing that, and these instruments are making, like, a chord"."* – Male, 31 (Interview)

*"So as someone who likes playing music, I'll think about music in the same way now. Whereas before because I do some home recording. Whereas before it would be sort of very come up with an idea, mess around with it, maybe record it, done with it. Now I look at that piece and I think, rather than just being done with it, I think maybe I could add or remove something, mess around with it and then I might end up with something that starts with certain layers and then some are removed, some are added, things like that."* – Male, 26 (Interview)

While the majority of compositional knowledge cited was gained from listening to in-game music, deconstructing it and then re-creating it outside the game, one participant cited that she had been inspired to create midi files to bring tunes she liked into games she was creating using RPG Maker.

> *"RPG Maker is probably my best example there. I was even inspired to start writing my own midi files and stuff like that although they were really rubbish. Because it was like oh how can I make this music in here and I was speaking with people online about oh could you maybe make this tune into a midi file and figure this out? So that I can have this tune in the background of my game."* – Female, 31 (Interview)

*Literacy* involved instances where participants had learned new words in their second or first language. This usually occurred when non-English speakers were able to learn the meaning of English words

> *"English is not my native language, and when I was a kid most games were not translated into Spanish. I loved them anyway, so I played them even though I couldn't understand a word. Sometimes I got stuck on parts of a game because of this. Little by little, by connecting words I didn't know with the actions they caused in the game, I learned English."* – Male, 27 (Narrative Survey)

One participant also cited the uncommon words which many JRPG's (Japanese Role-Playing Games) used as enabling him to gain a greater vocabulary.

> *"One of the reasons why I think I've got a very good vocabulary is from gaming because a lot of the time when I was a kid there would be a lot of words that would come up that I didn't know the meaning of. Like, for example, I don't know why I remember this, but it was in, I think it was in one of the earlier Final Fantasy games, might have been FFVIII or FFIX a word came up: it was "nefarious". Now I was 11 or 12 at the time and I was like "what the **** does that mean?", but I like words, like learning about new words. So, when a word like that came up I would always go and look it up*." – Male, 31 (Interview)

*Motor* related to skills such as manual dexterity, coordination and reaction speeds. Participants mentioned instances

> *"Getting your dexterity better and coordination better and feel[ing] yourself being more skilful when you play and being able to react more quickly and things like that."* – Female, 33 (Interview*)*

> *"I didn't think I could gain the manual dexterity to use and learn the controls successfully and I did."* – Female, 58 (Narrative Survey)

In essence, the *learning* theme encompassed a range of different skills and knowledge which participants cited learning from games. The learning taking place within the games was informal and occurring as a by-product of the gameplay. Occasionally the learning which occurred (especially within the *history and culture* category) inspired players to go and find out more about the topic in question. This was usually achieved via looking things up on the internet and using

external resources such as books. In terms of the *social* category, participants mentioning gaining important social skills through teamworking and mentoring other players in online games. Often this would link to learning *game specific* skills, or, if more experienced, then imparting their knowledge to enable new players to learn the game. *Cognitive* covered the broadest range of skills with the most common being problem-solving. Others cited included reasoning, critical thinking, recognising patterns and using games as a form of mental exercise.

#### 4.2.3.2 Discussion

In the current study learning was defined as largely informal, unstructured and where the learning occurring was a by-product of the gameplay itself (OECD, 2017). Participants were asked what they felt they gained from engaging in creative practices in digital games, and also, what they felt they gained from particularly engaging in gaming experiences.

Participants noted that games facilitated learning about a variety of topics or developing various skills and competencies. In addition to the active learning in relation to creative problem-solving and strategy formulation inherent in games, participants also cited learning about history as well as gaining *literacy*, *cognitive*, *social* and *technical skills.* The most frequently referenced skills came under the *cognitive* category where participants cited skills such as problem-solving, mental dexterity, reasoning, working out patterns and increased organisational skills. This finding is echoed by other studies such as Voulgari et al.'s (2014) study looking at learning in the MMORPG *World of Warcraft* (Blizzard Entertainment, 2004) which found that players learn various cognitive related to conceptual knowledge, organisational and strategic knowledge and problem-solving processes (Voulgari et al., 2014). Similarly, Iacovides et al. (2014) found that through gameplay players could develop cognitive skills such as problem-solving as well as games being used as a form of mental exercise. This was similar to one participant in the current study who cited using *StarCraft II* (Blizzard Entertainment, 2010) as a form of mental preparation before challenging real life situations.

Other categories such as *literacy* and *social* mirrored previous research. For example, both Chik (2014) and Bytheway (2015) found that players employed a variety of L2 language strategies within MMORPGs, while the link between the development of social skills and game playing has been well documented (e.g. Boyle et al., 2016; Sourmelis et al., 2017).

References to learning about *history and culture* also echoed previous findings regarding the propensity of digital games to contribute to historical learning. For example, Beavers (2019) found that games can promote a closer relationship between players and historical contexts by allowing players to become actively engaged in historically-based narratives. Through this active engagement, players can subsequently obtain a greater understanding of the historical period. On a similar note, several participants spoke of games prompting them to seek further information

on historical periods depicted in games – something which is echoed in other work such as Iacovides et al. (2014) who found that tangential resources such as Wikipedia were used by players to find out further information about real world events depicted in games. Unlike the other *learning* categories which were largely referenced as incidental by-products of gameplay, the learning involved in *history and culture* was made more explicit due to the presence of a specific learning goal (e.g. finding more information about Ancient Greek mythology).

The *motor* category was the least mentioned and referred to the development of motor skills such as dexterity, reaction speed and coordination. Again, previous studies have suggested games can facilitate the development of such skills – for example, in Voulgari et al.'s (2014) theoretical framework for learning outcomes and processes in MMOGs, the learning outcome category of "skill-based" includes psychomotor and kinetic skills. Furthermore, the development of motor skills could be linked to functional challenges (Cole et al., 2015) in games which require dexterity, reaction speed, skill and strategy to overcome. It is worth noting, however, that the majority of references relating to *motor* skills were in relation to games in general as opposed to specific creative instances.

An additional creative skill discovered related to *music* where participants cited gaining musical inspiration and composition knowledge from in-game music and soundtracks which they were later able to incorporate into their own musical compositions. This related to the theme of *transferability* (discussed in section 5.3.5) as this particular skill was utilised in participants' hobbies outside of the game.

It is worth noting that in the context of this study participants were asked two questions regarding learning in games. Firstly, they were asked what they felt they gained from engaging in gaming experiences other than enjoyment, and secondly, they were asked what specifically they felt they gained from being creative in games. Many participants mentioned *cognitive* skills for both questions, suggesting that they may have been considering learning in general from games and hence there was little distinction between the two to be made, especially within the *cognitive* category. This may, however, have been due to the fact that creativity encompasses a variety of different skills – many of them cognitive. This includes skills such being able to think of alternative solutions to problems, being able adapt to existing problems, being able to critically evaluate situations and tools and the ability to reflect on oneself and other elements of life (Craft, 2000; Loveless, 2002).

In essence, the majority of findings relating to learning mirrored those of previous studies which examined learning in general from digital games. The current study focused on creativity and what specific instances of learning may occur from creative action within games. While the boundaries of what skills are learnt from games in general and learnt specifically from being

creative remain blurred, participants explicitly mentioned gaining creative cognition skills such as divergent and analogical thinking. An additional skill found related to the acquisition of musical knowledge whereby participants stated they were able to pick out instrumentation, chord sequences, musical notes and melodies from the game. Finally, while affective change was covered in the *creativity as affective change* theme, it could also be considered as a form of learning in terms of the accommodation process that takes place. In this way, the process of accommodation allows an individual's personal interpretative frame to be altered when it is challenged by contradictory knowledge (von Glasersfeld, 1995), such as games which provide perspectives into other cultures or identities.

### 4.2.4 Creative Transfer

*Transferability* was an inductive theme and covered instances where participants referenced using creativity which had been developed or inspired by games in other areas of life, or vice versa. See table 14 for theme descriptors.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Transferability | Ideas | Ideas gained from games transferred to other creative pursuits outside of games, or ideas developed outside of the game transferred to creativity within the game. Includes: musical composition, inspiration to learn music, arts/crafts, writing fiction and using ideas in other games including non-digital games. |
| | Life Skills | This involved instances where participants had cited general skills gained or developed during gaming sessions. These included reasoning, problem-solving and organisational skills as well as changing attitudes and behaviours in other areas of life. |
| | Job Related | This category involved instances where games had enabled or helped participants in their real-life work/education. |

*Table 14: Transferability Sub-Theme Descriptors*

#### 4.2.4.1 Findings

The most frequently occurring category in *Transferability* was *ideas* which involved instances where participants had developed ideas within games and then had gone on to use them in other creative pursuits outside of the game, or vice versa. Usually, this tended to be in the form of creative inspiration where games had "given me ideas and inspiration [for] things that I can create myself" (female, 31, interview). This included instances where games had inspired participants to write about characters/narrative in their own works of

fiction, create art or crafts based on the game, incorporate ideas from games into their *Dungeons and Dragons* sessions, or incorporate elements or ideas from the game's music into their own compositions.

> *"So I like writing, I like music, so playing music, things like that. And with the writing, it's easy to kind of say you see interesting storytelling, you might pick up elements of it to incorporate into your own stuff."* – Male, 26 (interview)

While the majority of references in the *ideas* category were concerned with the actual application of ideas to real-life creative pursuits, participants who had not done this were able to identify areas which they felt could benefit from the creativity in games such as cataloguing their ideas in a "portfolio-type environment to move into a media/creative direction" (male, 23, interview) and using skills developed in online games such as "conflict resolution, recruiting" (female, 53, interview) in other areas of life.

Most references involved creativity and ideas from games being transferred outside the games, however, some participants cited instances where ideas inspired by real-life had been transferred to creativity within the game. This was most commonly cited in relation to sandbox games where participants could re-create real-life objects or places.

> *"I used Cities Skylines's map warehouse to download a topographical map on mars into the game. I then created a city in a crater that is actually real geography on mars."* – Male, 33 (Narrative Survey)

> *"I feel it's rather the other way around. Being creative and thinking critically in life allows me to do the same in games."* – Male, 28 (Narrative Survey)

The second most frequently occurring category in the *transferability* theme was *life skills*. This involved instances where participants cited using what they had learnt or developed in digital games in their everyday life. This included aspects such as "being open to using something in a different way [and] looking at problems in a new way" (female, 29, narrative survey), and finding "new options to solve what I have to confront in my daily life" (male, 27, narrative survey), and applying game-related strategies to make things more efficient in real-life.

> *"Speedrunning has helped me to, like, it's funny, when I finish doing a speedrun, when I go about my daily life, you know, I don't do it fast but I feel like OK, I can spot how to do something more efficiently, so to speak."* – Male, 36 (Interview)

Unlike, the *ideas* category, the *life skills* category did not involve the transfer of ideas, however, the transfer of learning. The learning involved was closely connected to the *cognitive* category in the *learning* theme (see section 5.2.5), which included skills such as problem-solving, reasoning and critical thinking. Additionally, participants mentioned how games had influenced the way they

managed and organised things in real-life.

> *"For example, every time I'm, I don't know, packing something or organising something, I think for myself or when people say oh you did it so neat. And I always joke I do a lot of Tetris….I always associate how well I organise everything with Tetris. And I don't know if I just jokingly say that, or if that's a point. But I really think of Tetris every time I'm reorganising something."* – Female, 28 (Interview)

In terms of the category of *job related* most references cited instances where games had a) inspired participants to study a certain topic as a formal qualification or b) the learning and development gained during gameplay had helped them in their job. In the former, participants mentioned games had inspired them to learn about literature and history, providing them with rich ideas in which to incorporate into their own creative works.

> *"Well the degree I'm doing at the minute is literature with writing. And the writing side of that I feel is heavily influenced by the games I've played over the years that have given me a passion for fantasy and sci-fi and all that."* – Male, 21 (Interview)

In terms of the latter, the learning gained from engaging in gameplay was utilised in participant's real-life jobs. This was most notable in terms of people management and teamworking skills where participants had taken leadership roles in Massively Multiplayer Online Games such as *World of Warcraft* (Blizzard Entertainment, 2004). This often involved co-ordinating large amounts of players, each providing a specialist role to the group. Participants who cited this as an example said that it had not only provided them with valuable leadership and people management skills such as "dealing with people who are disappointed or angry" (male, 41, interview), but also given them more confidence when faced with similar roles in their jobs.

> *"I was going for a promotion at work to lead a team which I'd never done before. I…remember sitting at the computer one day and thinking hang on a minute if I'm going to lead a team in real life surely I can do that in the game. So I…went off with a tank and led, for a couple of years, led a raid team, which really was, although the idea came from the idea of doing it in real life, I did the game first. So it's almost like that helped me practise for when I got the job and did it in real life. It certainly gave me the confidence. Once I've led a load of people in a raid at home it's then easier to go off and lead a load of people at work."* - Male, 32 (Interview)

Additionally, participants cited the way games had enabled them to think and work more efficiently or consider alternative solutions to be useful in their jobs.

> *"I used to be a manager for a retail store and having that ability to think of multiple avenues for the same issue and things like that helped a lot. It's not a one-to-one conversion of I've played some shooters so now I know how to shoot guns because that's ridiculous and not how it works at all. It's more you're exercising the logical, problem-solving part of your brain and that*

*definitely transfers over because there's a lot of creativity in logic and a lot of creativity in problem solving."* – Male, 26 (Interview)

*"Currently I drive a lot with Uber and things are rapidly changing doing that and I think, you know, doing things like speedrunning, helps me to prioritise pathways differently when I'm driving."* – Male, 36 (Interview)

While the majority of participants cited using learning or ideas gained from games in other areas of life, three participants also cited games had influenced, or been used in their jobs as educators. This was especially evident in one participant's quote who cited using an open-world game which allowed him the freedom to create new challenges for his students which mirrored real-life concepts such as obedience.

*"I'm a professor and I use games in my classes to teach sociology concepts. So, for example, I created a list of "deviance achievements" in Grand Theft Auto for students to try and get during a play session in class. They had to do things like creep behind pedestrians without them noticing and try to follow traffic laws."* – Male, 35 (Narrative Survey)

Similar to the *ideas* category, learning was not only transferred from the game to real-life occupations but also from real-life occupations to the game. One participant noted that his creative side in games mirrored that of his real-life occupation in IT support.

*"I'd say that's probably where my creative side at least comes in, in that I'm a problem fixer and I get creative with fixing problems. I work in IT support, it's my job, people come to me with problems and I fix them, so it's, yeah, I guess second nature in a way."* – Male, 27 (Interview)

In conclusion, the most frequently occurring category in transferability was *ideas* which included the transfer of ideas and creative inspiration from digital games to real-life creative pursuits, or vice versa. Examples included ideas for written work, musical composition or arts and crafts. Less often mentioned was the transfer of creativity from real-life to the game. *Life skills* involved the transfer of various cognitive skills such as problem-solving, reasoning and organisation. Participants cited that the ways of thinking which games promoted were useful in their everyday lives such as prioritising things or managing money. In *job related*, participants also noted that games provided them with various transferable skills which aided them in their real-life jobs. Frequently mentioned were people management and leadership skills, the ability to consider alternative solutions and working efficiently. Similar to the *idea* category the transfer of skills and knowledge was multi-directional and also occurred from real-life jobs to the game. Additionally, participants mentioned using games as teaching aids or applying game logic to their teaching.

#### 4.2.4.2 Discussion

*Transferability* was divided into three sub-categories involving the movement of creative skills or inspiration from digital games to real-life or vice versa. *Ideas* related heavily to creative inspiration afforded by games, *life skills* related to the creative cognitive processes and ways of thinking and *job related* referred to creative skills which were then used in domain specific instances.

In terms of *life skills*, participants noted that the creative thinking involved in strategy formulation and approaching problems was carried over to their everyday life. This category was not linked to any specific real-life context, and thus tended to be domain unspecific. It has been argued that creative performance requires a set of creativity relevant skills. Such skills can be defined as being able to generate alternatives, engage in divergent thinking, think creatively or suspend judgement (Amabile, 1988). Many of the processes and cognitive skills participants cited using could be illuminated by the Creative Cognition approach (Finke et al., 1999) which stresses the importance of various cognitive processes in the application of creativity. These cognitive processes are transferable and include skills such as divergent thinking (generating many alternative solutions or ideas) or metaphorical and analogical thinking which involves the combination and transformation of ideas, the ability to apply already existing ideas and solutions to a new context and being able to combine existing unrelated ideas to form a new solution (Arieti, 1976; Runco, 1991; Sanchez-Ruiz et al., 2013).

It has been suggested that creativity involves skills which are transferrable, and thus should be domain unspecific (Rogaten & Moneta, 2016), however, previous studies which examined creative thinking processes such as divergent thinking found that there was very little overlap between domains (i.e. divergent thinking in one task could not then be applied to another) (Baer, 1998, 2016). It is worth noting that these studies were carried out in educational settings and involved children as participants. Participants in the current study played games in leisure or competitive settings and were adults. It could be that there was less demarcation between playing games as a hobby and other aspects of life and the enjoyment and satisfaction gained from using creative thinking practices in games encouraged the further use of these practices in daily life.

For all sub-categories, participants also expressed the view that creativity itself is something which can be developed, and the more creative they were in games, the more likely they were to be creative in other aspects of life. This included using the aforementioned cognitive processes associated with creativity such as divergent thinking, as well as the movement of ideas from the game to real-life (e.g. such as the game inspiring an idea which the participant then went on to write a fanfiction about).

For the category of *job-related* participants mentioned instances in which they had been inspired by games to go and study for formal qualifications in certain topics or where they had used the skills developed through gameplay in their jobs. In terms of the former, games had inspired participants to learn more about certain subjects. In the latter, participants cited using a variety of skills such as planning, organisation and interpersonal skills in their workplace. It is worth noting that these skills were not directly related to any specific creative gaming instances and aligned more with general skills developed from playing games. Contrastingly, the application of these skills in the workplace was associated with creativity: participants frequently mentioned that these skills enabled them to think of alternative solutions of workplace issues and, in terms of interpersonal skills, able to see arguments from various sides. While the initial gameplay may not have been deemed as "creative", the transfer of the skills was described as leading to creative action.

For the *Ideas* sub-category, participants mentioned instances where they had used ideas inspired by the games they played in creative pursuits outside of the game or vice versa. As specified previously, the majority of participants already engaged in creative pursuits outside of digital games and this may have had an impact on their likelihood to generate ideas from games. Conversely, it could be argued that as all participants in the study were regular gamers, their gaming may have had an impact on their likelihood to be creative in general. Studies have found that those who regularly engage in digital game play are more likely to be creative (Jackson, 2012; Jackson et al., 2012), and that playing digital games increases curiosity, motivation and joy associated with being creative (Ott & Pozzi, 2012). This gives further weight to the question of whether creative individuals are more drawn to video games in the first place; something which may be given further momentum by a "Matthew effect" (Walberg & Tsai, 1983) (i.e. those who are already competent continue to improve) where "individuals already higher in creativity continue to enhance those skills even as those lower in initial creativity begin to play games" (Bowman et al., 2015, p.56).

The notion that games may be able to inspire *ideas* and further creative action, could be illuminated by the creation of external resources such as fanfiction, fan art and gaming forums. Many participants cited that they wrote about the games they played, creating stories based on the characters or settings. It has been suggested that the transferability of creativity from the game to real-life can be seen in the emergence of such external resources where players can share their gaming knowledge or game-based creative works. These mediums in themselves may constitute an alternative form of play where players are able to collaborate, share and build on each other's ideas (Newman, 2004).

Participants talked about how elements of their lives such as their hobbies and friendships moved between games and the real-world. This included meeting real-life friends in games, or in the case of the *Ideas* category taking ideas from the game and incorporating them into other creative pursuits. Just as the movement of social relations bled from real-life to the game and vice versa, it could be argued that the diffusion of creativity was just as evident. Just as Castronova (2008) argued that we will see a "virtual migration" with people's attention shifting between the real and virtual, the shifting of both creative outputs and creative inspiration may also be included. While most participants mentioned the migration of creative ideas from the game to real-life, a couple also mentioned that their creativity in everyday life made them more creative within games, suggesting that the transfer of creativity is not seen as a one-way process. Instead, as Lehdonvirta (2010) argues, aspects games such as social relations and identity flow multi-directionally from the real world and the virtual. While the transferability of creativity and creative skills in games has yet to be given due credit in research, this initial study highlights that participants view creative inspiration and output to diffuse between the real-world and the virtual.

In essence, this study found that various aspects of creativity were transferrable between games and real-life, including various *life skills*, creative *ideas* and *job-related* competencies. In addition, participants cited that the more creative they were in games, the more creative they were in everyday life and vice versa, suggesting digital games may foster creativity as other studies have suggested (Jackson, 2012; Jackson et al., 2012; Ott & Pozzi, 2012), or alternatively that creative individuals may be more drawn to digital games, and hence, become more creative as a result (Bowman et al., 2015; Sherry et al., 2006; Ventura et al., 2012).

### 4.2.5 Design Affordances

*Design affordances* was an inductive theme which centered on the specific design elements which facilitated player creativity. See table 15 for theme descriptors.

| Main Theme | Sub-Themes | Description |
|---|---|---|
| Design Affordances | Freedom of Play | Encompasses what a game affords in terms of how players can choose to play (e.g. are there multiple ways of doing something? Is it suited to multiple playstyles?), how accessible it is to test the boundaries imposed by developers and how accessible it to mod and adapt? |
| | Environment | Includes opportunities to interact with the environment such as being able to utilise terrain and environmental objects, as well as opportunities to explore as typical in games with an open-world design. |

| | | |
|---|---|---|
| | Replayability | Encompasses what affordances for replay there are (e.g. are there different endings? Can the game be played differently on each playthrough? Can each playthrough be a different experience?). |
| | Tools | Opportunities for players to use different types of tools. This includes weapons, abilities, controls and items. |
| | Avatar | Possibilities for avatar customisation, such as appearance, dialogue options and classes. |
| | Creation | Affordances for creating in-game content such as building or crafting things and usually found in sandbox style games. |

*Table 15: Design Affordances Sub-Theme Descriptors*

#### 4.2.5.1 Findings

The most frequently occurring sub-theme in the *Design Affordances* theme was *freedom of play*. This included instances where players described games which allowed them to do things multiple different ways and gave them the freedom to experiment with different solutions, supporting *creativity as problem-solving*.

> *"I definitely feel like that is a good example (citing Legend of Zelda: Breath of the Wild) of a game where you can basically just use your imagination and do what you like and the game rewards you for it and then you get this good feeling from it too."* – Female, 31 (Interview)

Participants also mentioned games which allowed the player to complete the game in a non-linear fashion, choosing which path/route to take as well as the opportunity to engage in side activities. This added variety to the play experience and included references to crafting, cooking, side quests as well as games where the developer had accounted for every possible interaction by the player.

> *"There's also the cooking mechanism, I don't know if you've seen that, there's loads of different things that you can cook with. And it's very much trial and error to figure out what's going to give you your best potions because certain food gives you different stat boosts. So that's, like cooking I suppose is a game within itself, and I do enjoy games with mini games in them. I think it adds like a new layer."* – Female, 29 (Interview)

> *"Often in videogames things are supposed to be achieved in a particular way. That's why people follow guides and tutorials, that's why playthroughs used to be so similar between players. When you realize you're playing a game where you're not asked to just go from A to Z, and where problems and puzzles can be solved in thousands of ways, sometimes in the most apparently uncanny way you could imagine, using every item or enemy or character in your*

*surroundings... it makes the game feel like a true challenge, and the victories feel much more real."* – Male, 36 (Narrative Survey)

Additionally, players talked about how games which allowed the use of mods provided further challenges and created new possibilities in terms of what could be done, supporting *creativity as appropriation*.

*"(I) sort of got into modding quite gradually - because I sort of played through the games so many times I was basically skipping to the mid game, and then finishing the mid game, getting bored and starting again. So, downloaded a couple of mods and it just opened up so many possibilities I couldn't go back now."* – Male, 21 (Interview)

*"Minecraft: I started playing that in I believe 2009, and it's one of the few games that I keep coming back to, mainly because of the whole idea of, like there's always new stuff to do because of all the mods."* – Male, 28 (Interview)

The players who preferred using mods tended to be those who had already completed a game multiple times or spent a significant amount of time playing it, suggesting another level of creativity in the creation of new possibilities which are not already built into the game by developers. Using mods in this regard could also be viewed as providing another layer to replayability, giving games a new lease of life.

The second most frequently occurring sub-theme of *Design Affordances* was *environment*. Participants who referenced this theme usually referred to open world type games such as *Legend of Zelda: Breath of the Wild* (Nintendo, 2017) and *Monster Hunter: World* (Capcom, 2018) which afforded multiple opportunities to use and explore the environment, often facilitating *creativity as problem-solving* by allowing interactable aspects of the environment to be used in potential solutions.

*"So you can get like little balls of water mossy stuff and there are monsters that cover themselves in mud to protect themselves…but if you shoot the little ball of moss from your crossbow thing then it actually cleans the mud off the monster and it's like the game doesn't tell you this is a thing that you can do, but you can just go around and pick up little clumps of moss and pew-pew them."* – Male, 23 (Interview)

*"I'm playing Breath of the Wild, and I'm very impressed about how many things you can do and how they affect all your surroundings. How interactive it feels."* – Female, 28 (Interview)

*"I'm playing Just Cause 3 at the moment and that, the whole kind of exploring, finding something, ooh I wonder what that is."* – Male, 40 (Interview)

Use of the environment or environmental objects usually was not explicitly stated to players in tutorials, allowing them to discover what aspects of the environment they could use.

This in turn added to the sense of discovery and achievement players felt from finding these things out on their own, without the hand-holding of some more linear games. Participants also cited the possibilities which non-linear games provided in terms of exploration of the environment and game world. Many participants stated this to be one of the main sources of enjoyment in the game in that they were given freedom to explore beautiful virtual environments.

The third most referenced sub-theme was *replayability* which included opportunities for each playthrough to be a different experience. Affordances for replayability usually centered around games which had multiple endings and/or were choice-based or games which were open world or online where there was the unpredictability of other players. Examples of games which were open world or online usually involved players having the freedom to defeat the same enemies or complete the same challenges but using different solutions and strategies. Referencing *StarCraft II* (Blizzard Entertainment, 2010), one participant depicted how each match was a different experience and even while using the same strategies they could be used in an alternative way.

> *"You can do the same strategy over and over again, but you can play it differently. Like you could place the buildings at another place or you could show that you're playing a standard game, but in fact you're doing something else."* – Male, 34 (Interview)

In terms of games which offered players the freedom of choice in how they chose to complete quests, players could revisit scenarios and choose to progress the narrative differently, providing scope for *creativity as affective change.* One participant, referencing *The Witcher 2: Assassins of Kings* (CD Projekt Red, 2011), spoke about how each playthrough could be completely different depending on the choices and consequences of the player's actions.

> *"(There is) like two completely different areas depending on your choice at that stage in the game. Obviously, that's quite a big branching part of the story. But like I said even with small sub-quests there's consequences depending on what you choose. It can be anything as little as what item you get as a reward, right up to, effecting quests staged through the game later on."* – Male, 31 (Interview)

The feeling that gameplay is a non-linear experience was an overarching theme in the *Design Affordances* node, with players often citing games which afforded this as being the most enjoyable.

> *"I played the game a certain way, and then maybe I'm talking to someone or I'm watching a video or maybe I'm playing the same game but a long time after. And I do something differently and I'm like oh. It's something I like about video games when that happens because it makes you feel... Like it's less of a straight line, you know, there's multiple options to achieve even the*

*same thing or to get different events or endings or whatever. That's something I like."* – Female, 28 (Interview)

The sub-theme *tools* encapsulated the possibilities for autonomy in terms of game items, weapons, abilities and actions and supported *creativity as problem-solving* and *creativity as appropriation*. Participants talked about being able to use different combinations of weapons and abilities which they had discovered themselves as opposed to being explicitly taught about them in a tutorial. Usually these tools or combination of tools was found by accident or through experimentation, adding to the feeling of achievement when players were able to find them on their own.

*"I remember I used to play Streets of Rage when I was a kid and you just tapped on 1 or 2 buttons and you had jump, punch and kick and that was your lot. Whereas now, you have a whole arsenal of different weapons. You can run, you can duck, you can slide, you can jump over things, you can hide in the scenery, you can use the scenery, you can destroy the scenery. There is just a whole more possibilities that just weren't there, like 20 years ago."* – Male, 31 (Interview)

*"League of Legends…when you know that amongst the, I don't know how many champions there are, 120 champions or so at the moment, when you come up with ways to connect abilities, to create outcomes that are highly positive for your group."* – Male, 34 (Interview)

The sub-theme *avatar* encapsulated player autonomy in terms of the main character or avatar's appearance and personality. This theme related to *creativity as appropriation*, whereby some participants talked about using game armour to change their character's appearance – even if that armour was worse off in stats than other, less aesthetically appealing attire. In this way, the player is able to adapt the rules of the game in terms of what to prioritise (appearance over the more obvious stat upgrades) and create a more unique gaming experience.

*"I've been calling it Fashion Hunter (as opposed to Monster Hunter) because I'm ignoring what's good gear and, you know, good armour and good weapons and I'm going for what I think looks good. I'm mixing and matching things and making things."* – Male, 26 (Interview)

Furthermore, affordances for *avatar* could support *creativity as affective change* in relation to having control over a character's personality through dialogue choice. In this way players could explore the game from the perspective of different standpoints, sometimes highlighting uncomfortable aspects of their personalities as one participant noted when she tried to play a renegade character (characterised by aggressive, ruthless dialogue options) in *Mass Effect* (Bioware, 2007) and "I can't bring [myself] to be that type of person even though it's not real" (female, 21, narrative survey).

In terms of the *creation* sub-theme which referenced the possibilities for creating in-game objects, the most frequently referenced game was *Minecraft* (Mojang, 2011) which participants cited as affording near complete freedom in what they could do in terms of building things. Other games cited were *LittleBigPlanet* (Sony Entertainment, 2008), *Cities: Skylines* (Colossal Order Ltd., 2015) and *Kerbal Space Agency* (Squad, 2015). Games which allowed players to create game objects, levels and maps provided opportunities for *creativity as appropriation.*

> *"I do prefer creative games. I spent a good two years on Minecraft. Where the idea is to build fantastical things and it's basically just a big Lego box isn't it? Just a Lego box and that was brilliant fun. And I do find that games where I can create things myself as opposed to just living out a story are the best ones for me."* – Male, 32 (Interview)

> *"You can make anything you want in Cities Skylines and Kerbal Space Agency."* – Male, 33 (Narrative survey)

In conclusion, participants cited various game affordances as promoting creative behaviour in games. These included what *freedom of play* the game developers had allowed for, such as playstyle, how accessible the game was to adapt or mod and how accessible was to test the game boundaries, supporting both *creativity as problem-solving* and *creativity as appropriation*. Additionally, participants cited interactivity with the *environment* which supported *creativity as problem-solving*, availability of game *tools* (e.g. character control options, weapons, abilities) which supported *creativity as problem-solving* and *creativity as appropriation*, *replayability* factors which supported *creativity as affective change*, *avatar* customisation options which supported *creativity as appropriation* and *creativity as affective change* and affordances in terms of *creation* of in-game content which supported *creativity as appropriation.*

#### 4.2.5.2 Discussion

*Design affordances* related to the different types of possibilities a game afforded for the expression of creativity. These affordances related to what tools players could use, what alternative ways something could be achieved, what possibilities there were for interaction with the environment and if each game playthrough could be a unique experience.

In terms of the current study, the majority of participants cited enjoying games where they could experiment and try different things to see what the outcomes would be. While linear, single player games offer some of these possibilities of play, the predominant type of game which was referenced in relation to *design affordances* was MMOGs or open world games. For these types of games, players are allowed almost complete freedom, with choices for play constantly evolving. Participants cited games which afforded the most possibilities to be the most engaging, something which could be illustrated by Salisbury and Tomlinson's (2016) tenth condition for flow which states that "an activity must present an opportunity for meaningful growth of the self

which is valued by the individual" (Salisbury & Tomlinson, 2016, p.72). Referencing Alan Cooper's (1999) concept of the idealised persona, they argue that games which are designed to cater for different personas (e.g. playstyles) such as open-world games are able to meet this requirement most easily. This is due to open-world games offering meaningful opportunities for play to different types of players. In the current study, participants mentioned enjoying different aspects of open-world games such as exploring the environment, engaging in social play activities or being able to utilise a variety of tools and actions to personalise their gameplay.

Additionally, developers often release patches and additional downloadable content for these types of games, meaning the gaming experience is constantly being refreshed and injected with more choices and ways of play (Herodotou et al., 2012). It has been argued that games are moving away from more restricted, rule-bound play to looser boundaries and greater freedom for players. According to Caillois (1958) the move from *ludus* (highly structured play) to *paidia* (loosely structured play) affords greater improvisation and creativity to players. This "openness" allows for greater player interactivity and personalisation in terms of gameplay (Herodotou, 2009).

While the majority of participants cited open-world games to be liberating in terms of the possibilities afforded to players, some participants also mentioned more structured games. In these cases, while the game may not have afforded the multitude of possibilities which an open-world game might, there were still allowances in terms of strategies used and experimenting with game variables. Creativity in these, more structured games, bordered more strongly on appropriation as often the game could be played in an alternative way, such as in the case of speedrunning.

The possibilities of play were not solely confined to mechanics and resources inherent within games. Participants also mentioned the use of mods in terms of creating these possibilities such as adding a new variety of tools, new characters or new challenges. The players who cited using mods preferred playing the game with them, however, they had all played the games without mods beforehand. In this way, the possibilities were created by the players themselves as opposed to being "built in" by the developers; a distinction which is synonomous with Schäfer's (2011) implicit and explicit participation. It should be noted that not all games afforded the possibilities of including mods. According to Burri (2011) games can fall under three categories based on their restrictions to players for introducing UCC. Firstly, some games do not allow any scope for UCC such as mods and the player fills the role of consumer. Secondly, there are games which involve possibility for UCC but its use is heavily restricted by the developers. Thirdly, there are games which are shaped and defined by their UCC where players are free to introduce and share game content and additions. All the participants who cited using mods to create new

possibilities for play referenced games which largely fell into the latter category, such as *Minecraft* (Mojang, 2011) and *Skyrim* (Bethesda Game Studios, 2011).

## 4.3 Conclusion

Phase 1 aimed to address the research questions of *RQ 1a: How is creativity expressed within digital entertainment games?* and *RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?* In total data from 38 participants was collected in the form of 24 semi-structured interviews and 14 narrative surveys.

RQ1a was answered using a deductive approach whereby pre-existing literature themes were used to categorise data into the three forms of creative expression (*creativity as problem-solving*, *creativity as appropriation* and *creativity as affective change*). These were then refined further inductively into higher-level sub-themes. RQ1b was answered using a purely inductive approach which focused on players' explicit conceptualisations of creativity (i.e. as opposed to deductively categorising based on previous literature). In addition, the inductive themes of *learning, transferability* and *design affordances* were uncovered which helped inform research questions for subsequent phases and provided initial data.

In terms of how players expressed creativity in digital games three categories developed. Firstly, in line with previous work, creativity was expressed in terms of *creativity as problem-solving* which related to the ways in which players are able to identify novel solutions to problems through reflecting on their actions, using trial and error approaches or researching and adapting existing strategies. An additional way in which players express creativity was found to be the ways in which they approach challenges and the coping mechanisms which they use. Secondly, creativity was expressed in terms of *creativity as appropriation* relating to the ways in which players adapt and incorporate games into their lives, including both creativity within the game such as adapting the rules, and creativity around the game such as the creation of external resources. Finally, creativity was expressed in terms of *creativity as affective change* which related to the novel and meaningful interpretations of the game, and subsequently how these interpretations are accommodated into the wider beliefs and identity of players.

In terms of how creativity was conceptualised three distinct viewpoints emerged. In *ways of thinking* it was cited that creativity in digital games encompassed the unique ways of thinking which games promoted such as "thinking outside the box" and considering alternative solutions. This conceptualisation tied in closely with the expressivity of creativity as problem-solving as it encompassed many creative cognition skills. Secondly, in *constructing in games,* creativity was conceptualised in terms of the creation of game content such as building houses in sandbox style games or creating content using the game's pre-packaged content creation editor. This conceptualisation of creativity was synonymous with Little C approaches, whereby games act as a foundation for players to pursue their curiosity and explore game design and development. Thirdly, in *games as an artform* creativity was conceptualised from a development and design

standpoint where games were viewed in the same way as art, films and writing. The creativity involved in games was cited from the developer's side in terms of the effort and creative ability involved in designing a game. This type of creativity was most synonymous with the "professional" creative works of Big C approaches.

While all player perspectives were distinct in their own right, the majority of participants did not adhere to any single one but instead held multiple conceptualisations of creativity (i.e. some participants conceptualised creativity as *ways of thinking* but also in terms of *constructing in games*). This gives weight to the argument that creativity is a multi-faceted construct, consisting of more than one element. In *ways of thinking* creativity can be seen as a process, whereas in *constructing in games* it can be seen as the creative outputs of "amateurs" – creators who produce primarily because they love the act of producing something in and of itself (Lastowka, 2012). In *games as an artform*, creativity can be seen on the societal level whereby game design is dictated largely by trends in the gaming industry and consumer patterns, or in the case of indie games; as a platform to "break the mould" of mainstream gaming.

In terms of what players may learn from being creative in games remains a somewhat grey area. Participants cited many learning outcomes from gameplay including the themes of *cognitive*, *social*, *literacy* and *history and culture*, however, it was ambiguous as to whether these skills had been acquired specifically from being creative in games as opposed to gameplay in general.

While it was difficult to directly link the development of cognitive skills to creative instances in the game, participants stated that the development of cognitive skills in games allowed them to think creatively in everyday life. Linking with the *ways of thinking* conceptualisation of creativity, participants cited that being creative in games provided them with various *life skills*. This included creative cognition skills such as combining and adapting ideas, applying existing ideas to new contexts and considering alternative solutions. Participants cited using these skills in their everyday lives, suggesting that these skills were domain unspecific – something which goes against previous findings on creative cognition skills (Baer, 1998, 2016). This could be explained by the fact that previous studies used educational settings, whilst participants in this study played games mainly for intrinsic purposes and of their own accord. The enjoyment and satisfaction gained from developing these skills in games may have encouraged further use of them in daily life.

A common area of creative transfer was in terms of *ideas*, where participants cited using ideas and inspiration gained from playing games in other creative pursuits outside of games. This included creating art based on games, writing stories based in the game world and fusing digital game elements with traditional tabletop games such as Dungeons and Dragons. Linking the

learning category of *music,* participants cited using the musical compositional knowledge gained from playing games in their own compositions. Some participants also cited that the music in games had been a driving force behind. Finally, participants cited that being creative in games made them more likely to be creative in everyday life, with some participants also citing that creativity also flowed conversely from real-life to the game. This highlights that like other aspects of games such as social relations and identity, creativity may flow multi-directionally from the real to the virtual.

## 4.4 Limitations and Future Recommendations

This study was conducted with participants who played a variety of different types of games, both online and offline. Using semi-structured interviews as the primary research instrument was successful in providing an initial exploration of the research topic. Using an exploratory approach also enabled other interrelated themes to emerge such as learning, transferability and design affordances. Additionally, the opportunity to collect another round of data in the form of narrative surveys aided in triangulation of data (Blandford, 2013). However, several limitations are noted in relation to this study.

Firstly, some participants asked for clarification on what was meant by being "creative" on the question which asked them "do you think you are or can be creative when you play games?". It was explained to them that the definition of "creative" was up to them and to how they viewed what it meant to be creative. It should be noted, however, that the majority of those who participated in this study already engaged in a variety of other creative activities such as music, writing and art. The few who did not deem themselves to be creative in this sense still believed games were a creative medium in terms of problem-solving, appropriation and affective change. This may have possibly led to respondent bias in favour of those whose identity and beliefs aligned with being already creative. For future studies, it may be wise to examine a sample of participants with varying degrees of creative self-efficacy to account for wider differences in perspectives of creativity. It would also be illuminating to investigate the differences in perspectives on creativity of those with high versus low creative self-efficacy.

Secondly, there is the argument that creative individuals are more drawn to games in general and that as a result they may become more creative (Bowman et al., 2015; Jackson, 2012; Sherry et al., 2006; Shute et al., 2015). As such, it would be useful to conduct a comparative study of gamers and non-gamers to determine perceptions of creativity, as well as what aspects of creativity transfer between domains.

Thirdly, 16 out of the 24 interview participants were male which may have resulted in a possible gender bias. Currently there is a fairly even gender split in terms of gaming activity, with the Entertainment Software Association (ESA) in the US stating 46% of gamers are female and 54% male (ESA, 2019). In Europe the numbers are the same (ISFE, 2019) and in the UK the numbers are similar with 42% of gamers being female and 58% being male (Ukie, 2018). While several females had responded to the recruitment emails, predominantly male volunteers went on to schedule interviews. Due to time restrictions on this study it was not possible to recruit additional female participants for interviews. For future studies it would be worth attempting to gain an equal number of both genders by targeting female specific gaming groups and societies. Furthermore, it has been suggested that creativity may differ between males and females (e.g.

Hamlen, 2009; Yeh, Lai, & Lin, 2016) and as such, the findings presented in this study may align more towards male orientated expressions and views of creativity. As such, in future studies, it would be enlightening to examine a wider sample of male and female respondents to compare differences in conceptualisations and expressivity of creativity in digital games.

Fourthly, due to the unexpected interest in this study a further data collection phase was implemented involving narrative surveys. This was chosen due to the time restraints of the overall PhD project which meant additional interviews could not be accommodated. The low response rate (14 out of an initial 97) for the narrative surveys could have been attributed to the fact that those who volunteered had done so primarily for interviews. While the narrative surveys proved useful in gaining additional data, it would have been better to have a higher response rate to help generalise findings from the interviews. This could be achieved by wider advertising for narrative survey respondents. In the case of this study, no new advertisements were put out for specifically narrative survey volunteers.

Fifthly, interview participants were offered an incentive to take part in the study in the form of an £10 Amazon voucher and narrative survey participants were offered the opportunity to take part in a prize draw for an £20 Amazon voucher. While participants appeared enthusiastic to take part and talk about the role of creativity in gaming, there is the possibility that the incentive may have had an effect on recruitment numbers and/or responses.

Finally, all questions on the narrative surveys were optional (except for consent and gaming habits). While initially this had been done to provide greater flexibility to respondents in the case of not all questions applying to them, in reality it led to some gaps in the data. This happened when respondents missed questions, such as in the case of one respondent who cited creative actions in games but then missed the question asking if they thought games were creative and why. This led to ambiguity as to whether this respondent believed games to be creative or not. It would be wise for future studies using the narrative survey instrument to ensure that core questions require an answer.

## 4.5 Summary and Implications

Using a hybrid thematic approach phase 1 identified three main expressions of creativity: *creativity as problem-solving, creativity as appropriation* and *creativity as affective change*. These expressions were identified as over-arching themes in the literature review, and inductively refined into higher-level themes during data analysis. These themes are also encapsulated in the definition of creativity provided in section 2.2.3 of the literature review. As such, one main contribution of this phase is to provide an account of the different forms of creativity unique to digital games aligned with the definition of creativity used. These expressions of creativity include

a wide range of creative acts - from problem-solving activities to content creation and personalisation to the formulation of personally meaningful insights and viewpoints. Not only does this provide a wider account of different creative aspects, but it unifies and synthesises previous literature with empirical findings. These categories provide implications for educationalists as to what aspects of creativity may be developed through playing digital entertainment games, and for future researchers who wish to use these themes as a means of categorising creativity both within digital games and other domains.

A second contribution of this phase is to provide insight into creativity as a core element of player experience. Explicit player conceptualisations of creativity were identified inductively from the data which found there were three overarching conceptualisations of what it means to be creative in games from a player's perspective: *ways of thinking, constructing in games* and *games as an artform*. Previous work has examined motivation and engagement as key elements of player creativity (e.g. Kiili, 2005; Sweetser & Wyeth, 2005), however, the importance of creativity is often overlooked from the perspective of the player. The participants in this study spoke enthusiastically about their creative endeavours, and for the propensity of games to develop their creativity. The majority of participants held multiple conceptualisations of what it means to be creative in games, providing support for the argument that creativity is a multifaceted construct (Shute & Wang, 2016). By using a bottom-up, inductive approach to understanding what creativity looks like from a player's perspective, developers may have greater insight into designing games with creativity in mind.

Finally, this phase provided implications for the next two phases. A greater amount and variety of data was collected than previously anticipated in the form of 24 semi-structured interviews and 14 narrative surveys. As such, this strengthened the development of further inductive themes relating to *learning, transferability* and *design affordances*. As such, phase 2 will attempt to generalise the findings from this phase to a wider sample of players and create a metric based-on phase 1 findings which accounts for the specific expressions of creativity unique to digital games. Furthermore, phase 2 will attempt to draw a link between learning outcomes and creative forms and investigate what aspects of creativity may be most transferable between games and other areas of life.

*[This page is intentionally left blank]*

# 5. Phase 2: Learning and Transferability in Digital Games

This study constituted the second phase of the project and aimed to generalise findings from Phase 1 to a wider demographic and investigate what particular learning outcomes players gained from engaging in game-based creativity, and whether such creativity and learning outcomes may transfer to other areas of life. As such the specific research questions this phase aimed to address were:

*RQ2 a: What do players learn from engaging in game-based creative practices?*

*RQ2 b: What aspects of game-based creativity are transferrable between games and real-life?*

Section 5.1 will detail the technicalities of the study such as the research instrument, recruitment and data analysis. It will also give an overview of the respondents involved in the study. Section 5.2 will present and discuss the results of the factor and regression analyses. Section 5.2.1 will detail the initial twenty-factor solution. Section 5.2.2 will detail the final five-factor model relating to three types of creative expression (appropriation, problem-solving and affective change), transferability and design affordances. Section 5.2.3 will cover RQ2a which was addressed using multiple regression to identify the relationship between the factors related to expressivity of creativity (*problem-solving, appropriation, affective change*) and learning outcomes. Section 5.2.4 will cover RQ2b which was addressed using multiple regression analyses to identify the relationship between *transferability* and other factors, and secondly, by identifying the relationship between the *transferability* and learning outcomes. Section 5.3 will coalesce and summarise the main points from the findings with explicit reference to answering the research questions. Section 5.4 will present the limitations of the study along with future recommendations. A final section (5.5) will explicate the implications of the study.

## 5.1 Participants and Demographics

### 5.1.1 Research Instrument

In order to generalise findings from the previous phase and, in particular, identify what skills players gain from being creative in games, and where they use them, a survey was deployed as the research instrument for this phase. The survey consisted of two parts: the first, the demographic and gaming habits questionnaire used in phase 1 which asked respondents questions such as what types of games they play, what gaming mediums they use, how many hours they spend playing and what type of gamer they identify as, if any.

The second part consisted of three subscales relating to how creativity was expressed (relating to *creativity as problem-solving, creativity as appropriation* and *creativity as affective change*), one subscale relating to player conceptualisations of creativity, one subscale relating to design affordances for creativity, one scale relating to learning outcomes, and one scale relating to creative transfer. Items were developed by encapsulating the themes derived in Phase 1 within a set of key statements. For example, the sub-theme of *games as an artform* was encapsulated by the items 20.3 (Games should be viewed as art forms like novels and films) and 20.6 (Games are like performances, similar to plays and films), while the *creativity as problem-solving* subtheme of *creating strategies* was encapsulated by items 23.1 (I enjoy coming up with new strategies when I play games), 23.4 (I mainly overcome challenges using a trial and error approach) and 23.6 (I enjoy experimenting with what I can do using different game variables). The number of items per scale varied depending on how many sub-themes there were and how many statements were needed to fully capture all aspects of the sub-theme. See table 16 for subscale descriptors. For a full list of survey items please see appendix 1.

In addition to the Likert-type statements, one multiple answer question was introduced within the learning from creativity subscale. The multiple answer question comprised of a set of learning outcomes derived from the phase 1 *learning* theme, in addition to learning outcomes from previous literature (e.g. Iacovides et al., 2014; Sourmelis et al., 2017; Voulgari et al., 2014). This allowed respondents to select which learning outcomes they felt they gained from being creative, providing categorical data for use in the multiple regression analysis in section 6.2.5 which directly addressed RQ2a.

| Subscale | No. Items | Notes |
|---|---|---|
| 1: Player Conceptualisations | 8 | Items related to how players view creativity in digital games e.g. games as an artform. |
| 2: Design Affordances | 13 | Relates to the various game design affordances which support/promote creativity. |

| | | |
|---|---|---|
| 3: Creativity as Problem-Solving | 7 | Relates to the expressivity of creativity as problem-solving. |
| 4: Creativity as Appropriation | 10 | Relates to the expressivity of creativity as appropriation. |
| 5: Creativity as Affective Change | 12 | Relates to the expressivity of creativity as affective change. |
| 6: Learning from Creativity | 9 | Relates to the specific skills and knowledge developed from being creative in games. Includes multiple selection question where participants can tick all skills developed from being creative. |
| 7: Transferability of Creativity | 12 | Relates to other areas of life where respondents have used the skills or ideas developed from being creative in games. |

*Table 16: Subscale descriptors*

All scale items were graded on a standard Likert scale (Likert, 1932) with 1 being Strongly Disagree and 5 being Strongly Agree. An option of 3 signified Neither Agree/Disagree and was used as both a neutral response and in the cases of no opinion/don't know (DK). A DK answer was omitted due to previous literature which suggests that the inclusion of DK options do not improve data quality. This is due to a variety of reason such as respondents being discouraged from expressing meaningful answers. It has been suggested that respondents who may have an answer but just need some time to think about it, will choose a DK answer as it saves on cognitive effort (Glucksberg & McCloskey, 1981; Norman, 1973). Satisficing theory suggests that respondents may have latent attitudes that they are not immediately aware of and may involve significant cognitive effort (optimising). In the case of respondents with low motivation or cognitive ability, a DK option may discourage them from choosing an answer which accurately reflects their opinion, and instead choose the "shortcut" (Krosnick & Presser, 2010). Additionally, when there is the ambiguity of neutral and DK responses – it could be the case that a respondent with a neutral opinion would choose DK instead or vice versa.

Reverse coding was introduced for nine items which included negatively wording statements such as 22.12 (I dislike games which have many different types of actions, items and controls) and 25.10 (I do not enjoy games which make me question things). Each section included at least one negatively worded statement. While randomisation of items would have been beneficial to identify respondent fatigue and order effects, it was not possible to implement using the survey platform (OnlineSurveys.ac.uk). This is discussed further in limitations (section 6.3).

### 5.1.2 Piloting

The survey was piloted with six individuals prior to participant recruitment. Changes to the wording of some questions were made to allow clearer understanding. Additionally, a short note on the definition of glitches was given to aid understanding for those who may not have been aware of what constituted as a glitch.

### 5.1.3 Recruitment

Participants were recruited via both convenience and targeted sampling. The study advert contained a link to the online survey where participants could read detailed information on what the survey was about, how their information would be used, their rights for withdrawal and the contact details of the research team. Participants could also download the study information sheet for their records.

The study was posted on various gaming forums such as the Steam, Guild Wars 2, Bioware, Kerbal Space Program and CD Projekt RED. As wide a range of gaming forums as possible was chosen to capture multiple different game genres. When available, adverts where placed in sub-forums on off topic and community creation areas. Adverts were also placed in various speedrunning and game modding forums such as ModDB, Nexus Mods and sub-forums for various games.

Reddit was used to target specific gaming genres and groups such as r/speedrun, r/gamingpc, r/videogamefanfictions, r/AARwriters, r/gamedev. Posts were also created in various game sub-reddits such as r/wow, r/witcher3, r/dragonage and r/ggoverwatch and the survey specific sub-reddit r/SampleSize. Twitter was used to promote the study advert and hashtags used included: #gaming, #indiegames, #gamedevs, #videogamers and #modding. The study advert was also sent to the GamesNetwork mailing list and advertised on various Facebook pages, including OU Research Students.

Due to a high proportion of males in the sample, twitter was also used to target female gaming and tech groups using hashtags such as #girlgamers. Due to heavy restrictions on female gaming forums no adverts were posted on those forums.

### 5.1.4 Sample

The sample consisted of 251 respondents comprising of 160 males, 82 females, 6 nonbinary and 3 who preferred not to say. The most common age bracket was 25-34 (*n* = 108). Please see figure 10 for age distributions.

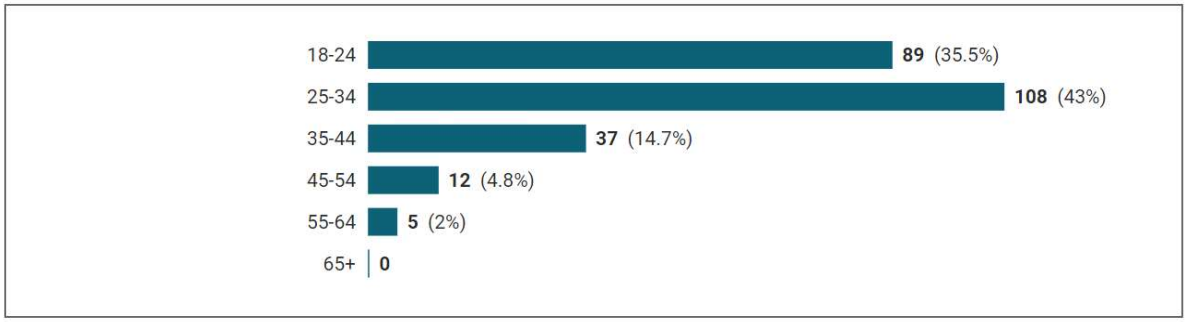



*Figure 10: Phase 2 Age Distributions*

The sample comprised predominantly American and European nationalities including 80 American, 36 British, 14 Canadian, 11 Dutch, 9 German, 8 Russian, 7 Danish, 7 Finnish and 8 French. The remaining respondents comprised various nationalities with 3 who preferred not to say.

The sample was fairly even across education levels with 81 who had an undergraduate degree, 60 college qualifications, 39 high school qualifications, 40 post graduate degrees, 18 doctorates and 10 in the other category.

The majority of respondents engaged in creative activities outside of games, with the largest creative activities being multimedia creation (*n* = 117), creative writing (*n* = 114) and cooking (*n* = 109). See figure 11 for other creative activities.

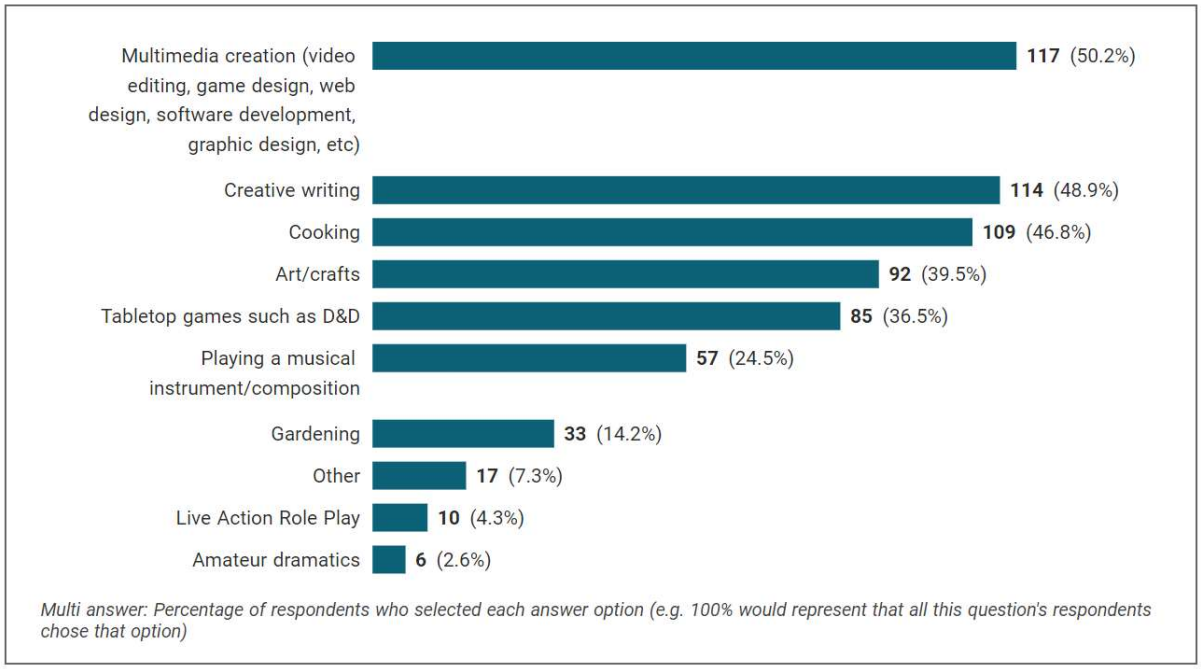



*Figure 11: Phase 2 Creative Pursuits*

Additionally, 103 respondents said that their creative pursuits were related to games. This included multimedia creation (level creations, modifications, code creation and video editing),

creative writing (fanfiction, After Action Reports), art/crafts (character/environment art), roleplay (based on games) and tabletop games (incorporating elements of digital games).

Respondents played a wide variety of games with the most common online game genres being MMORPG (*n* = 127) and MMOFPS (*n* = 106) and the most common offline game genres being Role Playing (*n* = 214), Action/Adventure (*n* = 187), Strategy/Tactics (*n* = 146) and First-Person Shooter (*n* = 124). 43 respondents reported they did not play any online games and 7 did not play any offline games. See figures 12 and 13 for genre distributions.

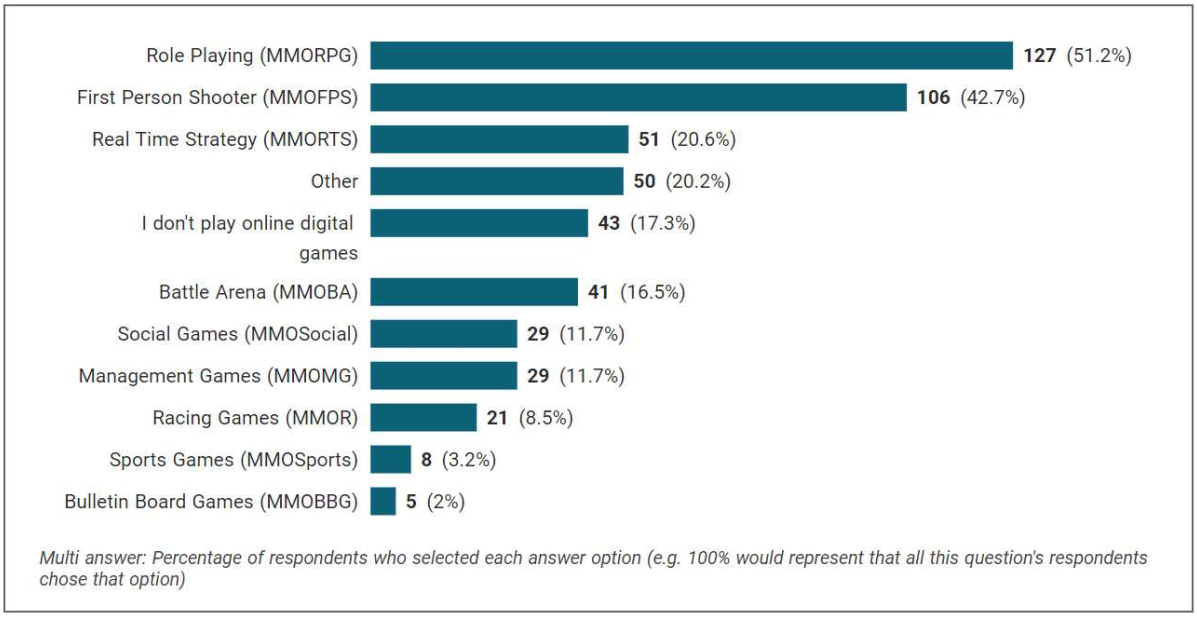



*Figure 12: Phase 2 Online Game Genre Distributions*

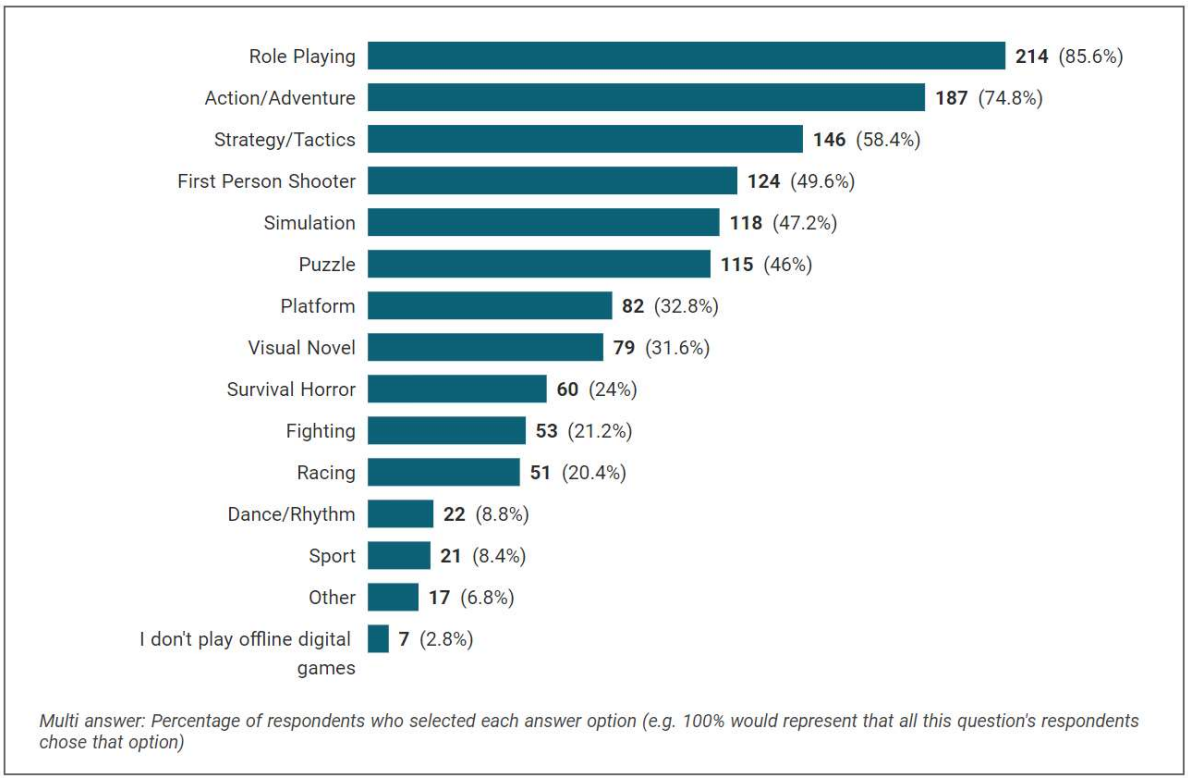



*Figure 13: Phase 2 Offline Game Genre Distributions*

The mean hours spent per week playing online games was 12.2 *(SD* = 14.4) and the mean hours spent per week playing offline games was 14.0 (*SD* = 12.3). The mean gaming session lasted 3.4 (*SD* = 2.3) hours. The most common gaming medium was PC/Mac/Linux (*n* = 222) followed by Console (*n* = 133).

Respondents were asked what type of gamer they felt most accurately represented them in terms of frequency of gaming or other. The largest category was Moderate Gamer (*n* = 135). Five respondents chose "other" which included participants who felt they were "hardcore" in certain types of games but casual or moderate in others. See figure 14 for gamer type distributions.

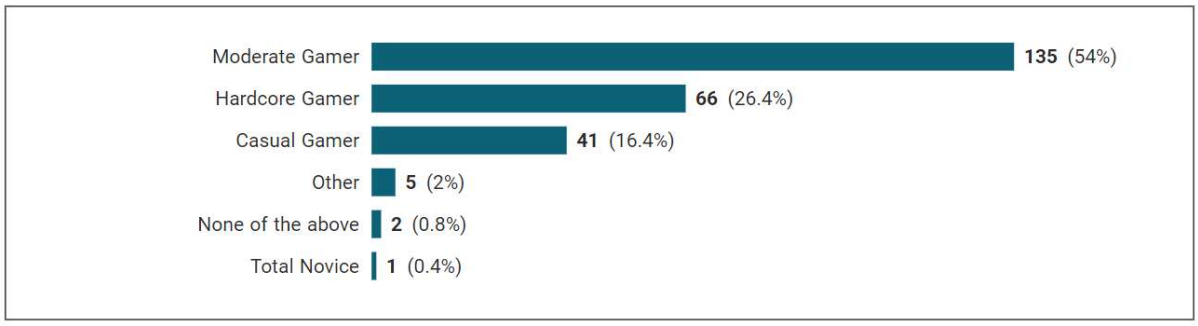



*Figure 14: Phase 2 Gamer Type Distributions*

### 5.1.5 Data Collection

The survey platform used was Online Surveys (formerly known as Bristol Online Surveys) which complies with both the EU and The Open University's Research Data Management standards as data are stored securely in the UK. The survey was available for a total of six weeks and advertisement was continuous during this time. After this time the data were exported for analysis into SPSS.

### 5.1.6 Data Analysis

Data analysis was carried out in SPSS 24. Analyses performed were factor analysis for scale reduction, reliability analysis and multiple regression to address RQ2a and 2b.

The first stage of analysis involved dimension reduction of scale items using Principal Component Analysis with Varimax rotation. Factor analysis is used to "summarize data so that relationships and patterns can be easily understood [and] to regroup variables into a limited set of clusters based on shared variance" (Gie Yong & Pearce, 2013, pp.79). These clusters, or "factors" are not measured directly but are hypothetical constructs used to represent a set of variables (Cattell, 1973). The two main types of factor analysis techniques are exploratory (EFA) and confirmatory (CFA), where the former seeks to explore the dataset, testing predictions and discovering underlying patterns within in, whereas the later attempts to confirm hypothesises by using by representing variables via path diagram analysis (Child, 2006). As the scale used in this study was newly created and hence not yet been validated, exploratory factor analysis was used to reduce and regroup the number of scale items.

It has been argued that EFA works best on larger sample sizes, with the recommended size being at least 300 respondents and there being at least 5 to 10 observations per variable (Comrey & Lee, 1992). However, others have reported EFA to work reliably on smaller sample sizes as small as 50 and 100 (e.g. de Winter, Dodou, & Wieringa, 2009; Kline, 1994), although this may be due to initially clear factor structures. Sapsford (2007) suggests that there should be at least twice as many respondents as scale items and for scale construction a sample of $n > 200$ is preferable. It has been argued that any cases with missing values should deleted to prevent overestimation (Tabachnick & Fidell, 2007). In line with this, listwise exclusion was used to deal with missing values for the scale data. In total 23 cases were excluded, leaving 228 valid cases. The common cut-off point of 0.3 for loadings was rejected in favour of a higher cut-off point of 0.45 which is described as fair to good (Tabachnick & Fidell, 2007). The majority of cross-loading items were also removed.

Total factor scores for each participant were then subject to multiple regression analysis to examine the relationship between transferability and forms of creative expression/learning outcomes (RQ2b), and forms of creative expression and learning outcomes (RQ2a). Forced (or simultaneous) entry was chosen for predictor variables where all predictors were entered in one block. In a forced entry model, all predictor variables are treated equally and is most appropriate when there is little theoretical basis for which predictors should be included (Cohen et al., 1983). This was chosen over hierarchical and stepwise entry methods. Hierarchical entry methods often rely on predictors being selected based on past research, and as this study was largely exploratory (i.e. not based on past studies), there was little basis to guide which predictors should be entered into the regression analysis, other than in the case of some learning outcomes which were referenced in phase 1 findings. Stepwise entry methods run the risk of suppressor effects where predictors may have significant effects but only when other predictors are held constant (Field, 2009). Additionally, it has been argued that stepwise methods remove many methodological decisions from the researcher and can contribute to over or under fitting (Cohen et al., 1983; Field, 2009).

The multiple regression analyses were bootstrapped with 10000 replications using bias corrected and accelerated (BCA) confidence intervals (CI) at 95%. Bootstrapping (Efron & Tibshirani, 1994) is a robust non-parametric resampling procedure which is used to estimate distribution properties based on sample data by computing a multitude of smaller samples from which means are calculated and used to acquire a sample distribution. From this bootstrapped sample distribution the standard error, standard deviation and confidence intervals are computed (Field, 2009). The benefit of bootstrapping is that no distributional assumptions are required in order to use it unlike standard parametric tests (Johnson, 2001), and results are based on a significant number of observations (Rochowicz, 2010).

## 5.2 Results & Discussions

Data was initially subject to principal component analysis, before refining the model according to the scree plot. The final factor model enabled the scale items to be condensed and allowed further analyses to be conducted.

RQ2a was addressed using three multiple regression analyses to identify the relationship between the factors related to expressivity of creativity (*problem-solving, appropriation, affective change*) and learning outcomes.

RQ2b was addressed using two multiple regression analyses. Firstly, by identifying the relationship between *transferability* and the other four factors to establish what types of creative expression were mostly likely to predict *transferability* scores, and secondly, by identifying the relationship between *transferability* and learning outcomes.

### 5.2.1 Initial Factor Analysis

Analysis of the 71 scale items produced a twenty-factor model accounting for 68% variance with a Kaiser-Meyer-Olkin value of .814. Barlett's test of Sphericity was significant ($X^2$ = 7555.407, DF = 2485, $p < 0.001$) indicating that a reasonable factor solution could be computed. The first rotated factor accounted for 9.3% of the overall variance (unrotated value = 18.3%) and included six items from the Creativity as Affective Change subscale, two items from the Transferability of Creativity subscale and one item from the Learning from Creativity subscale. The second rotated factor accounted for 6.2% of the overall variance (unrotated value = 7.5%) and included six items from the Creativity as Appropriation subscale, suggesting the subscale was already measuring one construct. The third rotated factor accounted for 5% of the overall variance (unrotated value = 5.5%) and included four items from the Creativity as Problem-Solving subscale, two items from the Design Affordances subscale and one item from the Creativity as Appropriation subscale. The remaining rotated factors included four items or less, apart from factor six which included four items relating to narrative and character personality and appearance.

The twenty-factor solution was subjected to six iterations of PCA with Varimax rotation, with all items which did not meet the required 0.45 loading being deleted on each round. Once all items loaded above .45, iterations were ceased. The Kaiser-Meyer-Olkin measure of sampling adequacy was still good at .803 and Barlett's Test of Sphericity was significant ($X^2$ = 5019.131, DF = 1378, $p$ = .000). The solution produced accounted for 67.9% of the variance with 53 items on 16 factors.

Analysis of the Scree plot indicated that five and six factor solutions would be possible (see figure 15).

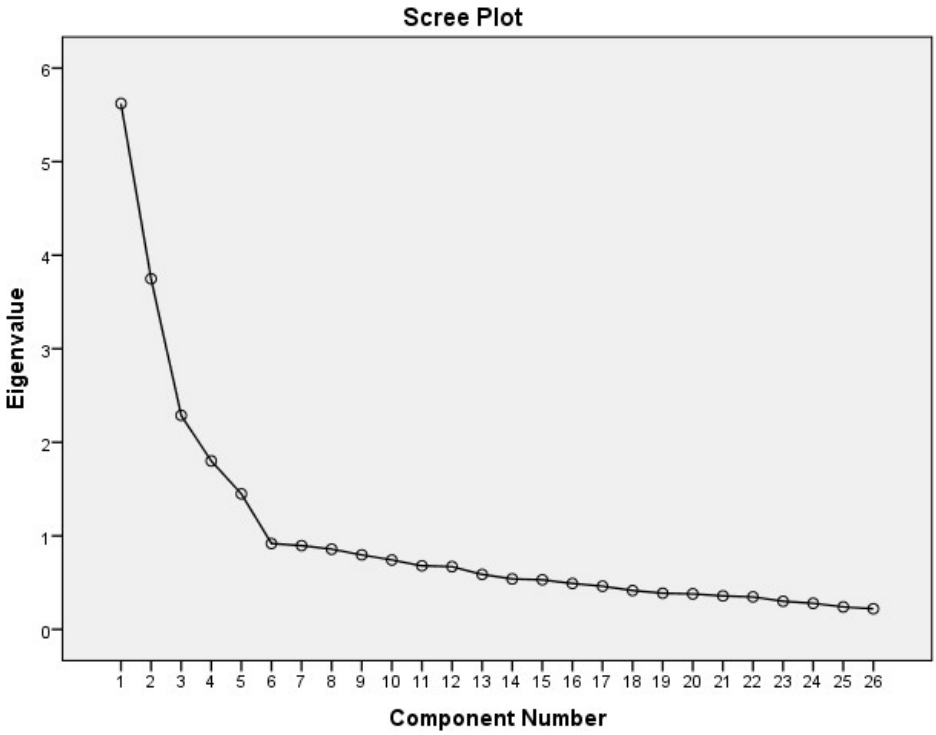



*Figure 15: Scree Plot*

Both five and six factor solutions were attempted, however, the difference in variance between the initial models was minimal at 55% for the five-factor solution and 56% for the six-factor solution. The five-factor model proved to be most useful in determining underlying constructs within the data and reducing the number of items in the scale. Due to the minimal variance difference (1%), the reduction in scale items and the comprehensibility of the factors, the five-factor solution was selected as the model of choice. As such, only the five-factor solution is presented.

### 5.2.2 Five-Factor Model

The same iterative process as the original twenty-factor solution was applied, resulting in a 26 item, five factor solution which accounted for 57.3% of the variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was good at .835 and Barlett's Test of Sphericity was significant ($X^2$ = 2303.942, *DF* = 325, *p* = .000). Determinant was above the acceptable 0.0001. The instrument was named the Creativity in Gaming Scale.

| Item | Transferability | Appropriation | Problem-Solving | Affective change | Design Affordances |
|---|---|---|---|---|---|
| 27.7 I have used what I have learnt from games in my job/workplace | .757 | | | | |
| 27.6 Games have influenced my attitudes or behaviours in other areas of life | .745 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 25.1 Playing games has made me come to view things in everyday life differently | .729 | | | | |
| 27.4 Being creative in games gives me a new perspective on problems and challenges in my everyday life | .722 | | | | |
| 26.6 Being creative in games has developed my problem-solving and thinking skills | .708 | | | | |
| 25.3 Playing games has made me realise things about myself | .680 | | | | |
| 27.10 I have used the skills and knowledge developed in games elsewhere in my life | .657 | | | | |
| 26.2 I have developed IT/technical skills through being creative in games | .581 | | | | |
| 24.2 I actively seek out glitches | | .781 | | | |
| 24.5 I enjoy using the game mechanics in new, unintended ways | | .779 | | | |
| 24.3 I try and find shortcuts in games | | .747 | | | |
| 24.4 I use glitches to enable me to progress in the game | | .743 | | | |
| 24.1 I like to test the boundaries of what the game allows | | .703 | | | |
| 24.10 I try and find ways to adapt and bend the rules of the game | | .693 | | | |
| 23.1 I enjoy coming up with new strategies when I play games | | | .802 | | |
| 24.8 I enjoy creating additional challenges for myself in games such as upping the difficulty | | | .722 | | |
| 23.5 I highly value the sense of achievement I get when overcoming difficult challenges in games | | | .646 | | |
| 23.6 I enjoy experimenting with what I can do using different game variables | | | .641 | | |
| 22.1 I enjoy games which allow me to try out different play styles | | | .640 | | |
| 25.5 The narrative of a game is important to me | | | | .692 | |
| 25.10 I enjoy games which make me question things | | | | .631 | |
| 25.6 I enjoy games which give me a new perspective of other cultures and societies | | | | .627 | |
| 22.7 I prefer games that let me choose the personality of my character through dialogue choices | | | | .565 | |
| 22.6 Games which allow more freedom for the player are more likely to involve creativity | | | | | .789 |
| 20.8 Games which allow the freedom to build and make things are the most creative | | | | | .779 |
| 22.10 Games which allow opportunities to interact with the environment help me be more creative in how I play | | | | | .461 |

*Table 17: Rotated Component Matrix for Five Factor Solution*

| Factor | Variance |
|---|---|
| 1: Transferability | 16.3% |
| 2: Appropriation | 13.7% |
| 3: Problem-solving | 11.3% |
| 4: Affective change | 8.9% |
| 5: Design affordances | 7.2% |

*Table 18: Factor Variances*

The first rotated factor accounted for 16.3% of the overall variance (unrotated value = 21.6%) and included two items from Creativity as Affective Change, four items from Transferability of Creativity and two items from Learning from Creativity. Learning items included problem-solving/thinking skills and IT/technical skills and may correlate with transferability items relating to the use of skills in domain specific instances such as job/workplace. Affective change items related to general changes in attitudes and perceptions (25.1: Playing games has made me come to view things in everyday life differently, 25.3: Playing games has made me realise things about myself). As the factor items all related to applying skills to other contexts or developing understandings beyond the scope of a specific game, the factor was named *Transferability*.

The second rotated factor accounted for 13.7% of the overall variance (unrotated value = 14.4%) and included five items from Creativity as Appropriation. The subscale was named *Appropriation* as items related to how games could be adapted and personalised for alternative gaming experiences.

The third rotated factor accounted for 11.3% of the overall variance (unrotated value = 8.8%) and included three items from Creativity as Problem-Solving (23.1: I enjoy coming up with new strategies when I play, 23.5: I highly value the sense of achievement I get when overcoming difficult challenges in games, 23.6: I enjoy experimenting with what I can do using different game variables), one from Design Affordances (22.1: I enjoy games which allow me to try out different play styles) and one from Creativity as Appropriation (24.8: I enjoy creating additional challenges for myself in games such as upping the difficulty). These items would suggest an overall alignment with Creativity as Problem-Solving, with games which allow players to try different play styles as being seen as supportive of this type of creativity. The subscale was named *Problem-Solving*.

The fourth rotated factor accounted for 8.9% of the overall variance (unrotated value = 6.9%) and contained three items from Creativity as Affective Change (25.5: The narrative of a game is important to me, 25.10: I enjoy games which make me question things, 25.6: I enjoy games which give me a new perspective of other cultures and societies) and one from Design Affordances (22.7: I prefer games that let me choose the personality of my character through dialogue choices). The items suggest a relationship between strong narrative and games which involve emotionally challenging themes which cause the player to question or reflect on aspects of life. Thus, the subscale was named *Affective change*.

The fifth rotated factor accounted for 7.2% of the total variance (unrotated variance = 5.6%) and included two items from the Design Affordances subscale (22.6: Games which allow more freedom for the player are more likely to be creative, 22.10: Games which allow opportunities to interact with the environment help me be more creative in how I play) and one from the Player Conceptualisations subscale (20.8: Games which allow the freedom to build and make things are the most creative). The items taken together suggested an underlying inclination towards games which allow the player freedom to interact with the environment, including the ability to create things themselves. The subscale was named *Design Affordances* as it is related to a preference for games that enable such opportunities.

#### 5.2.2.1 Mean Analysis

Means were computed for the five subscales (see table 19).

| **Subscale** | ***M*** | ***SD*** |
|---|---|---|
| Transferability | 3.8 | .83 |
| Appropriation | 3.3 | .75 |
| Problem-Solving | 4.2 | .69 |
| Affective change | 4.3 | .60 |
| Design Affordances | 4.0 | .77 |

*Table 19: Subscale Means for Five Factor Model*

The subscales of *problem-solving*, *affective change* and *design affordances* had moderately high mean vales ($M \geq 4.0$), suggesting that participants had a positive attitude towards playing games

that support problem solving, have emotionally challenging narratives and flexible game designs that can support creative actions.

Transferability had a slightly high value of 3.8, which could be attributed to the fact that the items which made up the *transferability* factor came from the original subscales of Transferability of Creativity, Learning from Creativity and Creativity as Affective change which were all later in the survey and hence may have suffered from respondent fatigue.

The subscale with the lowest value was *appropriation* ($M$ = 3.3), which suggests a neutral disposition towards activities associated with creativity as appropriation. The lower rating could have been down to the inclusion of two statements regarding glitches (24.2: I actively seek out glitches, 24.4: I use glitches to enable me to progress in the game) which had lower mean values ($M$ < 2.5).

#### 5.2.2.2 Reliability Analysis

Cronbach's Alpha was computed for each subscale individually and the scale as a whole to determine internal consistency (see table 20). Alpha values for the *transferability*, *appropriation* and *problem-solving* subscales were good at .86, .86 and .76 respectively. Both the *design affordances* and *emotional challenge* subscales had Alpha values of .60 and .62 respectively which are slightly lower than the acceptable value of .7 (Kline, 1999; Lopez & Snyder, 2003; Tavakol & Dennick, 2011), however, this could be attributed to the lower number of items in each of the subscales. Alpha for the scale as a whole was good at .82 suggesting a high level of inter-relatedness of scale items.

| **Subscale** | **No. Items** | **Alpha** |
|---|---|---|
| Transferability | 8 | .86 |
| Appropriation | 6 | .86 |
| Problem-Solving | 5 | .76 |
| Affective change | 4 | .62 |
| Design Affordances | 3 | .60 |
| **Whole Scale** | **26** | **.82** |

*Table 20: Alpha Values for Five Factor Model*

In essence, the five-factor solution provided constructs relating to *transferability, appropriation, problem-solving, emotional challenge,* and *design affordances*. Variance explained was satisfactory at 57.3%.

### 5.2.3 Multiple Regression: Learning

As phase 1 had indicated that participants felt they gained a variety of learning outcomes from being creative in games (see section 4.2.4), multiple regression was performed to determine the relationship between factors related to the expression of creativity and learning outcomes. It was hypothesised that learning outcomes would predict factor scores relating to the expressivity of creativity. Total factor scores for each participant were used as the dependent variable, and learning outcomes were used as binary predictor variables. Data was screened for multicollinearity issues (e.g. two variables relating highly to each other) prior to regression analysis, with no issues being detected.

#### 5.2.3.1 Results

| Dependent | Predictor | B | SE | Sig.p |
|---|---|---|---|---|
| **Problem-Solving** | Music | .63 | .46 | .183 |
| | Art/Crafts | -.44 | .50 | .369 |
| | Problem-Solving | -.15 | .75 | .836 |
| | Critical Thinking | .59 | .64 | .366 |
| | Reasoning | -.12 | .58 | .867 |
| | Language Skills | .34 | .42 | .406 |
| | Communication | .85 | .62 | .164 |
| | Confidence | -.35 | .52 | .520 |
| | Teamworking | .11 | .65 | .872 |
| | Leadership | 1.04 | .63 | .096 |
| | Technical Skills | .01 | .47 | .981 |
| | Motor Skills | .23 | .50 | .624 |
| | Reaction Speed | 1.67 | .52 | **.005**** |
| | History/Culture | .42 | .47 | .389 |
| | Empathy | -.56 | .43 | .209 |
| | | | | |
| | ***F* = 3.58** | ***R²* = .19** | ***Adj.R²* = .13** | ***P* = .000** |
| **Affective change** | Music | .08 | .43 | .873 |
| | Art/Crafts | .78 | .31 | **.012*** |
| | Problem-Solving | .20 | .53 | .697 |
| | Critical Thinking | .44 | .47 | .342 |
| | Reasoning | -.24 | .42 | .550 |
| | Language Skills | .40 | .34 | .233 |
| | Communication | -.40 | .42 | .333 |
| | Confidence | .20 | .44 | .656 |
| | Teamworking | -.28 | .40 | .468 |
| | Leadership | .08 | .37 | .813 |

| | | | | |
|---|---|---|---|---|
| | Technical Skills | -.11 | .32 | .733 |
| | Motor Skills | .13 | .35 | .708 |
| | Reaction Speed | -.74 | .36 | **.037*** |
| | History/Culture | .54 | .34 | .118 |
| | Empathy | .96 | .34 | **.003**** |
| | ***F* = 2.32** | ***R²* = .13** | ***Adj.R²* = .07** | ***P* = .004** |

*Significant values are highlighted in bold. ∗p < .05; ∗∗p < .01; ∗∗∗p < .001.*

*Table 21: Multiple Regression Models for Creative Expression x Learning Outcomes*

The regression model for *problem-solving* accounted for 23% of variance in scores ($F$ = 3.58, $R^2$ = .19, $p$ = .000 *(S)*). The learning outcome of reaction speed ($p$ = .005) positively predicted scores on this factor.

The regression model for *affective change* predicated 13% of the variance in scores ($F$ = 2.32, $R^2$ = .13, $p$ = .004 *(S)*). Scores on this factor were positively predicted by arts/crafts ($p$ = .012) and empathy ($p$ = .003) and negatively predicted by reaction speed ($p$ = .037).

The regression model for *appropriation* was non-significant ($F$ = 1.43, $R^2$ = .09, $p$ = .136 *(NS)*) and hence is not displayed. Similarly, the regression model for *design affordances* was non-significant ($F$ = 1.24, $R^2$ = .07, $p$ = .254 *(NS)*) and hence is not displayed.

#### 5.2.3.2 Discussion

In the regression model for *problem-solving,* reaction speed ($p$ = .005) positively predicted scores on this subscale. Digital games have been argued to consist of two types of challenges: physical and cognitive (Adams, 2014; Cox et al., 2012; Denisova et al., 2017; Schell, 2014). While cognitive challenges are associated with the mental abilities of the player such as memory and observation skills, physical challenges are those that require high accuracy, dexterity, endurance and fast reaction times (Cox et al., 2012; Schell, 2014). Similarly, the term functional challenge (Cole et al., 2015; Lazzaro, 2004) has also been used to describe the type of challenges which are inherent in the majority of games; requiring dexterity and fast reaction speed to overcome. As the majority of games combine both cognitive and physical elements within problem-solving tasks, one interpretation could be that the most likely skill to be developed in association with the physical element of such challenges is reaction speed.

However, it is worth noting that the learning outcome of problem-solving itself was not considered a predictor of scores on the *problem-solving* factor. This could be due to problem-solving itself consisting of a variety of other higher-level cognitive skills such as metaphorical association (Ortony, 1979), analogical transfer of information (Gentner, 1989), and identifying

practical and conceptual limitations (Finke et al., 1992); all of which were not accounted for individually within the questionnaire. Additionally, according to Treffinger (1995) and Treffinger et al. (2007), the creative problem-solving process consists of a series of different functions such as exploring information, framing problems, appraising tasks and generating ideas – all of which contribute to the umbrella skill of problem-solving, however, again were not accounted for individually within the questionnaire.

In the regression model for *affective change* scores were predicted positively by arts/crafts ($p$ = .012) and empathy ($p$ = .003) and negatively predicted by reaction speed ($p$ = .037). Affective change often comes about through emotionally challenging game narratives. The link between arts/crafts and affective change could be illustrated through the concept of narrative ambiguity which is created through leaving aspects of game narrative vague and open to player interpretation (Bopp et al., 2018; Cole et al., 2015). Through creating artworks and other creative resources, players are able to explore aspects of the game narrative, reflect and create their own version of the story. According to Curwood et al.'s (2013) ethnographic study, fan culture around games "can support the literacy practices in writing stories, creating art, producing songs and participating in role-playing games" (Curwood et al., 2013, p. 3). However, while the regression model tells us that players can develop art/craft skills through playing emotionally challenging games, it remains unclear whether the arts/crafts which players referred to are related solely to those games (e.g. in relation to fan art) or were created with no relation to those games.

Empathy could be explained by the role of emotional challenge itself in the gaming experience, whereby story and "characters provide a focus for potential empathy or counter-empathy" (Järvinen, 2008, p. 65). Games which are high in emotional challenge usually involve strong narrative structures, often leaving parts of the story ambiguous and requiring players to make difficult choices. As Cole et al. (2015) found, emotional and functional challenges tended to be antagonistic to each other, with games high in emotional challenge being low in functional challenge – something which could explain why reaction speed negatively predicted scores on this subscale as those who were more likely to enjoy emotionally challenging games may have been less likely to develop the dexterity and reaction speed associated with functional challenges.

The model for *appropriation* was the only form of creative expression which was not predicted by self-reported learning outcomes. One explanation for this could be due to the specificity of learning which may occur from engaging in game-based appropriation. For example, the survey included the category of technical skills, however, this was not broken down into more refined categories such as programming skills, digital media skills, etc. As such, there may not have been an appropriate learning outcome which fully captured the skills, if any, which may be

developed through creativity in the form of appropriation. Another interpretation could be that players may be able to relate creativity in the form of *problem-solving* and *affective change* more readily to the learning outcomes in the survey (e.g. affective change as a result of empathy towards game characters, etc), whereas the relationship between *appropriation* and the learning outcomes was not so clear cut. Furthermore, there may be other factors such as gender, and whether an individual engages in pre-existing creative pursuits, which may impact the likelihood that they may learn from this type of creativity. As the research questions did not relate to these aspects, such predictors were not included in the regression models, however, this could be an avenue to address in future research.

### 5.2.4 Multiple Regression: Transferability

#### 5.2.4.1 Transferability of Creative Expression

Inter-factor regression was carried out to determine the relationship between the transferability factor and the other four factors. Findings from phase 1 had indicated that various aspects of game-based creativity were transferrable (see section 4.2.5 for detailed descriptors). It was thus hypothesised that the *transferability* factor could be predicted by the remaining four factors. This enabled identification of what aspects of creativity were most likely to transfer between games and other areas of life. The dependent variable was total scores on the *transferability* factor, and predictor variables were total scores on each of the other four factors.

##### 5.2.4.1.1 Results

| **Dependent** | **Predictor** | ***B*** | ***SE*** | ***Sig. p*** |
|---|---|---|---|---|
| Transferability | Appropriation | .87 | .08 | .320 |
| | Problem-Solving | .59 | .15 | **.001**** |
| | Affective Change | .92 | .18 | **.001**** |
| | Design Affordances | -.21 | .22 | .326 |
| | ***F* = 15.15** | ***$R^2$* = .21** | ***Adj.$R^2$* = .20** | ***P* = .000** |

*Significant values are highlighted in bold. ⁎p < .05; ⁎⁎p < .01; ⁎⁎⁎p < .001.*

*Table 22: Multiple Regression Transferability x Other Factors*

The multiple regression analysis indicated that there was a positive relationship between scores on *transferability* and the *problem-solving* ($p$ = .001) and *affective change* ($p$ = .001) factors. There was no significant relationship between scores on the *appropriation* ($p$ = .320) and *design affordances* ($p$ = .326) factors and the *transferability* factor. The model accounted for 21% of the variance in scores ($F$ = 15.15; $R^2$ = .21; $P$ = .000 *(S)*).

#### 5.2.4.1.2 Discussion

The propensity of digital games to contribute to the development of a variety of transferrable skills has been documented (e.g. Barr, 2017, 2018; Clough & Ferguson, 2010; Qian & Clark, 2016; Sourmelis et al., 2017). However, the majority of work has labelled creativity as transferrable learning outcome in itself, and not examined creativity as in terms of being a catalyst for the development of transferrable skills. By breaking down creativity into the different expressions, the regression model illustrates that the two most likely types of creative expression to predict scores on *transferability* are *problem-solving* and *affective change.*

In relation to phase 1 findings, the *transferability* theme included three sub-themes. *Life skills* related to the skills and developments games promoted (e.g. problem-solving, reasoning, organisation skills, and affective elements) transferring to other areas of life in a generic sense (i.e. not domain specific). *Ideas* related specifically to the transfer of creative ideas and inspiration between games and other creative pursuits. *Job related* included instances where games had helped participants in their work or provided inspiration to study certain topics in education. The retained items in the *transferability* scale included items relating to the phase 1 sub-themes of *job related* (e.g. 27.7 I have used what I have learnt from games in my job/workplace) and *life skills* (e.g. 27.4 Being creative in games gives me a new perspective on problems and challenges in my everyday life), as well as items relating to the transfer of specific skills developed from being creative in games such as problem-solving (e.g. 26.6 Being creative in games has developed my problem-solving and thinking skills). The *transferability* subscale also included one item related to affective change (25.1 Playing games has made me come to view things in everyday life differently). As such, it may not be surprising that the factors of *problem-solving* and *affective change* were the strongest predictors of variance. The *problem-solving* factor includes statements related to the expression of creativity as problem-solving, while *affective change* involves statements related to enjoyment of games which encourage new perspectives and instigate questioning of world views.

While the model provides an indication of which forms of creative expression may be most likely to transfer, it only accounts for 21% in the variation of scores. As the five-factor model had significantly condensed the scale items, the remaining variance could be explained by items which were lost in the factor analysis. For example, not all the sub-themes of each type of creative expression were accounted for within their individual scales such as *affective change* which only included four items relating to the phase 1 sub-themes of *cultural, narrative* and *personal.* As such the remaining sub-themes such as *existential* and *games* were not accounted for by the remaining items. It could be that the expressions of creativity as *affective change* and *problem-solving* involve a far greater number of intricacies which are not covered by the items in the factor model. In relation to *appropriation* which was not significant in regression model, one

explanation could be that the creativity involved in appropriation is highly specific to games themselves such as finding glitches and new uses for game mechanics. There is also the possibility that creativity in the form of appropriation may be more domain specific, and as such most likely to transfer between games as opposed to other areas of life. The *transferability* subscale did not include any items relating to the transfer of creativity between games, and as such this could account for some lost variance.

#### 5.2.4.2 Transferability of Learning Outcomes

The phase 1 theme of *transferability* had highlighted that various aspects of creativity were transferrable to other areas of life. The phase 1 theme of *transferability* had established some of the areas of life where creativity may transfer to (general life skills, workplace, hobbies), however, it did not explicitly link the learning outcomes developed from being creative to transferability. While many of the sub-themes such as *life skills* incorporated skills developed through being creative such as cognitive skills, it was not established which specific learning outcomes were most likely to transfer. As such, it was hypothesised that there would be a relationship between some learning outcomes and scores on the *transferability* factor. Multiple regression analysis was performed using the total factor scores on the *transferability* factor as the dependent variable and learning outcomes as binary predictor variables.

##### 5.2.4.2.1 Results

| **Dependent** | **Predictor** | ***B*** | ***SE*** | ***Sig. p*** |
|---|---|---|---|---|
| Transferability | Music | 1.12 | .96 | .256 |
| | Art/Crafts | .49 | .72 | .506 |
| | Problem-Solving | 2.47 | 1.30 | .060 |
| | Critical Thinking | 2.34 | 1.05 | **.029*** |
| | Reasoning | -.15 | 1.00 | .877 |
| | Language Skills | 1.89 | .71 | **.009**** |
| | Communication | .82 | .88 | .339 |
| | Confidence | 1.82 | .87 | **.033*** |
| | Teamworking | .68 | .82 | .408 |
| | Leadership | 1.18 | .88 | .176 |
| | Technical Skills | 1.69 | .75 | **.020*** |
| | Motor Skills | .30 | .76 | .685 |
| | Reaction Speed | .16 | .83 | .846 |
| | History/Culture | 1.18 | .77 | .140 |
| | Empathy | 1.51 | .78 | .051 |
| | ***F* = 10.87** | ***$R^2$* = .42** | ***Adj.$R^2$* = .38** | ***P* = .000** |

*Significant values are highlighted in bold. ⁎p < .05; ⁎⁎p < .01; ⁎⁎⁎p < .001.*

*Table 23: Multiple Regression Transferability x Learning Outcomes*

The regression model for *transferability* accounted for 42% of variance in scores ($F = 10.87$, $R^2 = .42$ $p = .000$ *(S)*). The learning outcomes of language skills ($p = .009$), technical skills ($p = .020$), critical thinking ($p = .029$) and confidence ($p = .033$) positively predicted *transferability* scores.

#### 5.2.4.2.2 Discussion

Of the ten learning outcomes which were accounted for in the model, language skills ($p = .009$), technical skills ($p = .020$), critical thinking ($p = .029$) and confidence ($p = .033$) were the most significant in positively predicting scores on this subscale. It could be that these skills were the most likely to be developed within games and then used in other areas of life. For example, a body of work exists which examines how players are able to use commercial entertainment games for second language learning purposes (e.g. Bytheway, 2015; Chik, 2014; Peterson, 2016). It has been argued that commercial entertainment games provide players with a sense of autonomy is a key component of effective second language learning through gaming (Chik, 2014), as well as providing affordances for intercultural learning in online games through mixing with players from a range of different backgrounds (Thorne et al., 2009). While there is evidence to suggest that players do learn second language skills, in the current study there was no differentiation between the learning of first and second languages and hence it is unclear as to which participants were referencing when they selected "language skills" from the survey list.

Technical skills ($p = .020$) may suggest that players are able to use technical skills developed from being creative in games in other areas of life. However, technical skills are a broad category and can include multiple competencies such as programming skills, mechanical skills and digital media skills. The category was used as pre-existing literature identified technical-based skills as an area of learning from digital games (Alonso-Díaz et al., 2019; Iacovides, 2012; Perrotta et al., 2013; Voulgari et al., 2014) and as an important skill needed for the new economy (e.g. Kluzer et al., 2018; Partnership for 21st Century Skills, 2019), however, in future studies it would be beneficial to break down this category further to identify what technical learning aspects players are able to gain from engaging in creative gameplay.

The remaining skills which were significant in the model (confidence $p = .033$ and critical thinking $p = .029$) are synonymous with 21st Century (Partnership for 21st Century Skills, 2019) or Knowledge Age Skills (Clough & Ferguson, 2010) which included competencies such as critical thinking, empathy, leadership and problem-solving. While studies such as Barr (2020) indicate that gameplay does not result in the development of transferrable skills such as communication and resourcefulness, the findings from the present study lend support to previous work which has suggested games are indeed effective in developing transferrable skills such as confidence and critical thinking (Clough & Ferguson, 2010; Qian & Clark, 2016; Sourmelis et al., 2017). However, previous research has focused on a link between these skills and gaming in general, whereas the

present study solely focuses on what player's learn from being creative. Gaming has been argued to be a creative activity in itself (Jackson & Games, 2015), and this could account for the similarity in findings between the current study and previous studies which focused on learning from games in general.

## 5.3 Conclusions

This chapter sough to address *RQ2a* and *RQ2b* and detail the development of the Creativity in Gaming Scale (CGS). An initial PCA analysis of the 71 scale items present in the survey produced a twenty-factor model which was condensed into a five-factor model ($X^2$ = 2303.942, *DF* = 325, $p <$ 0.001). An iterative process of elimination was applied whereby all items which did not meet .45 loading were removed from the model. The final five-factor model accounted for 57.3% of the total variance, with factors relating to *transferability, appropriation, problem-solving, affective change* and *design affordances*.

Mean and reliability analysis was performed on the factor scores. Mean analysis demonstrated a positive valence towards creativity in terms of *problem-solving, affective change* and *design affordances.* The *transferability* and *appropriation* subscales demonstrated a more neutral disposition towards these constructs. Reliability analysis was satisfactory giving an alpha value of .82 for the whole scale. Being a multifaceted construct, the remaining variance could be explained by more complex aspects of creativity which were not captured in the factor analysis.

In relation to *RQ2 a: what do players learn from engaging in game-based creative practices?* multiple regression analysis was performed using factor scores as dependent variables and learning outcomes as binary predictor variables. The regression models for *problem-solving* (*F* = 3.58, *p* = .000, $R^2$ = .19) and *affective change* (*F* = 2.32, *p* = .004, $R^2$ = .13) subscales pointed towards what players may learn from engaging in different forms of creativity. Creativity in the form of problem-solving may help develop reaction speed whereas creativity as affective change pointed towards the development of art/craft skills and empathy, while being negatively associated with the development of reaction speed. This finding supports previous work suggesting emotional challenges may promote emotional exploration and empathy (Bartsch & Hartmann, 2017; Cole et al., 2015; Järvinen, 2008) and that emotional and functional challenges may be antagonistic to each other (Cole et al., 2015).

In relating to *RQ2 b: what aspects of game-based creativity and learning are transferrable between games and other areas of life?* it can be concluded that aspects relating to general world views and perceptions may be the most likely to transfer to other domains. Items 27.6, 25.1, 27.4, 25.3 and 27.10 all related largely to affective change, lending weight to previous research which has suggested that games can lead to reflection on experiences (Mekler et al., 2018), new perspectives (Oliver & Carr, 2009) and empathy (Bartsch & Hartmann, 2017; Bopp et al., 2018; Cole et al., 2015). The two items relating to specific skill development (26.6 and 26.2) referenced problem-solving and IT/technical skills, backing up previous work which has claimed games can help develop transferrable skills such as problem-solving and IT literacy (e.g. Qian & Clark, 2016; Sourmelis et al., 2017; Voulgari et al., 2014). Finally, in relation to the specific domains which

game-based creativity may transfer to item 27.7 indicated that such skills were used in vocational settings. However, as this was the only item which related to a specific domain, it could be that participants were simply using domain unspecific skills such as problem-solving within a vocational setting.

In terms of the transferability of creative expression, the regression model ($F = 15.15$; $R^2 = .21$; $p = .000$) indicated that the factors related to *creativity as problem-solving* and *creativity as affective change* were positive predictors of scores on the *transferability* factor. These two factors were most synonymous with aspects of the phase 1 *transferability* sub-theme of *life skills* which included the various cognitive competencies games promoted in addition to the way in which games prompted changes in perceptions and views in everyday life. *Appropriation* did not predict *transferability* scores, with one interpretation being that the creativity involved in appropriation may be highly domain specific and transferrable predominantly to other games (an aspect not captured within the *transferability* subscale). In relation to the transferability of learning outcomes the regression model ($F = 10.87$, $p = .000$, $R^2 = .42$) indicated that transferrable skills such as critical thinking, confidence and technical skills were positive predictors of scores. This is in line with previous research which supports the view that digital games may contribute to the development of a variety of transferrable skills (e.g. Binkley et al., 2014; Qian & Clark, 2016; Sourmelis et al., 2017).

## 5.4 Limitations and Future Recommendations

This chapter sought to answer the research questions: *RQ2a: what do players learn from engaging in creative game-based practices?* and *RQ2b: what aspects of game-based creativity are transferrable between games and other areas of life*? An online survey consisting of questions relating to demographics and gaming habits, in addition to Likert-type questions relating to the expression and conceptualisation of creativity, learning and transferability was utilised. While the response data enabled the construction of a five-factor model and regression models, several limitations were noted.

The sample consisted of a disproportionate number of males (160 males compared to 82 females) and as such the findings may reflect attitudes towards creativity in games by a male population. Previous findings have suggested that creativity may differ between males and females (e.g. Hamlen, 2009; Lin et al., 2012; Yeh et al., 2016). As such, it would be beneficial for a comparative study to be carried out to examine the differences in responses between the two genders in terms of the five scales produced from the factor analysis.

The sample was not stratified, and hence respondents were able to self-select if they wished to take part and as such it is difficult to generalise findings more broadly. While the survey was advertised as widely as possible, due to the self-selected nature of participation there is the possibility that those who self-identified as creative were more likely to take part. Indeed, the majority of respondents took part in creative pursuits outside of games. As has been argued elsewhere, creativity may be increased by playing digital games, and as a result, those who frequently play games may be more creative as a result (Jackson, 2012; Jackson & Games, 2015; Jackson et al., 2012). Similar to Phase 1, it would be beneficial to conduct a comparative study to examine differences in scores between those who self-identify as creative and those who do not.

The items were not randomised in this study due to the restrictions of the survey platform (onlinesurveys.ac.uk). As such, there may have been an order effect within the survey design which was not detected. In future studies this should be taken into account and measures taken to randomise item orders.

Finally, there is the possibility that participants answered the questions relating to learning from creativity in relation to learning from games *in general.* As feedback from one respondent noted it may be difficult to determine if the learning that takes place is from being creative or from something else entirely. As such, it would be beneficial for subsequent studies to establish a more robust measure of learning from *being creative* and learning from games *in general*.

## 5.5 Summary and Implications

Phase 2 sought to generalise the findings from phase 1 and examine the relationship between learning, creativity and transferability in more detail. The first main contribution of phase 2 was the development of a scale, named the Creativity in Gaming Scale (CGS) which captures the three forms of creativity identified in phase 1 (*creativity as problem-solving, creativity as appropriation* and *creativity as affective change*), alongside *transferability* and *design affordances*. Previous metrics which have sought to measure creativity in digital games have focused on existing psychometric properties (e.g. Chuang et al., 2015) and as such, do not take into account the different expressions of creativity unique to digital games. This novel CGS provides implications for educationalists and researchers into the effectiveness of digital games for supporting different forms of creative expression and development of circumorbital skills. Additionally, it may be used by game designers to assess whether their games promote certain forms of creativity in players.

The second contribution of phase 2 was to explicate what players may learn from being creative in games. Phase 1 identified learning as an inductive theme, and phase 2 attempted to identify the relationship between factors and learning outcomes. While some learning outcomes were significant in the models such as the development of empathy from *creativity as affective change*, the majority of reported learning outcomes were between the $p < .01$ and $p < .05$ significance levels. Similarly, the relationship between learning outcomes and transferability was vague, with some learning outcomes being significant in predicting *transferability* scores but none at the $p < .001$ significance level.

As such, based on a limited sample, this phase cannot concretely conclude that a) players may develop a range of competencies from being creative and b) give a definite conclusion as to what specific learning outcomes developed from being creative may transfer to other domains of life. However, participants in phase 1 spoke enthusiastically about creativity and learning (and the transfer of learning outcomes from being creative), highlighting that there may be a much more complex relationship between creativity and learning which requires further unpacking. While it is beyond the remit of this thesis to investigate this relationship further, these findings provide implications for educators in providing an effective learning environment which not only allows for learning but also for creativity.

Transferability was investigated in its relationship to the different forms of creativity expression. It was found that *creativity as problem-solving* and *creativity affective change* were the two main forms of creativity likely to transfer to other domains of life, with scores on the CGS factors of *problem-solving* and *affective change* significantly predicting a positive change in scores on the *transferability* factor. This may provide implications for educators and academics with regards to the development of transferable skills frameworks, specifically in terms of the role of

digital games in developing creativity as a transferable competency. In this way educators could select games which cater for a specific form of creativity (e.g. *creativity as problem-solving*) as part of a transferable skills curriculum.

Finally, phase 2 provides implications for the final phase of this study. *Design affordances* was an inductive theme from phase 1 which also came out as a latent factor from PCA in phase 2. Phase 3 will examine this construct in greater detail using reflexive photography alongside photo-elicitation interviews and using the pre-existing *design affordance* themes from phase 1 as initial categories to inductively refine further. Phase 3 will also attempt to coalesce the findings from phase 1 to link the various design affordances to different creative expressions.

# 6. Phase 3: Design Affordances for Creativity in Digital Games

This study aimed to extend and enhance the findings from phase 1 relating to the link between game design and player creativity. As such, phase 3 explored the particular design affordances which facilitated or inhibited player creativity in digital games. Hence, the research question for this phase was:

*RQ3: What specific game design affordances contribute to player creativity?*

The research instrument comprised of a reflexive photographic method whereby participants took screenshots of their regular gaming activity over the course of a week. This was followed by a photo-elicitation interview where participants selected three screenshots to discuss with the principal investigator.

Section 6.1 details the technicalities of the study such as recruitment procedures and demographics, in addition to providing an overview of participants involved. Section 6.2 presents the findings and discussions of the eight design affordances (identified deductively and inductively) which contribute to player creativity. Section 6.3 provides a concluding section and section 6.4 outlines the limitations of the study along with future recommendations. A final section (6.5) will explicate the implications of the study.

## 6.1 Participants and Demographics

### 6.1.1 Research Instrument

Similar to phase 1, phase 3 took an exploratory approach to answering the research question using a reflexive photographic method alongside photo-elicitation interviews. While reflexive photography has not been used in the existing context before, it has been used to examine personal experiences of learning (e.g. Schulze, 2007; Wallace, 2015). The method, described in detail in Chapter 3, provides participants with the autonomy to capture instances which are important to them and which they wish to discuss during the following photo-elicitation interview. This way, the participant is in the driving seat, choosing what to focus on during the interview, and providing the researcher with valuable pictorial data to provide context for discussions.

Unlike previous studies which used reflexive photography where participants took images on cameras, the participants in the current study took screenshots of gaming instances which they felt either facilitated or inhibited their creativity. Participants were provided with a

screenshot template as well as an information sheet containing guides on taking screenshots on various gaming platforms. The screenshot template (see appendix 2) provided sections for participants to paste their screenshot as well as add a caption and any additional information.

Similar to other reflexive photography studies, participants took the screenshots over the course of a week and at the end sent the researcher the images before taking part in the interview the following week. While previous reflexive photography protocol was followed (i.e. having a set amount of time for participants to take their images), one participant who took part already had an extensive collection of screenshots which captured instances of creativity. In this instance, it was deemed appropriate that the participant selected images from her existing library instead of replaying the instances in the games.

Interviews were semi-structured (see section 3.6.1 for protocol), providing a framework focusing on the research question but also providing flexibility in asking probing questions (Swain, 2018). However, while all participants were asked the same questions for each image, the questions were not always asked in the same order and participants were encouraged to elaborate on areas if they wished to do so. Prompts centered on the screenshots and asked participants to describe what was happening in the image, what they hoped to capture, how they would describe the creativity involved, what aspects of the game enabled them to behave in such a way and if they had had any similar gaming experiences before. An additional question asking participants to give feedback on the methodology used was asked at the end of the interview.

### 6.1.2 Piloting

Interview prompts were initially run through with three supervisors for refinement and the reflexive photography methodology was piloted by one colleague. Formal piloting was carried out with two participants selected from the recruitment pool. As no amendments were made to the interview prompts or method, their data was included in the main analysis.

### 6.1.3 Recruitment

Participants were initially recruited out of those who had taken part in the phase 1 narrative survey and phase 2 survey and had indicated they wished to be contacted regarding further research opportunities related to the PhD project. Participants were sent an invitation email explaining the purpose of the study and what would be required of them if they were to take part. Once participants responded to the email, they were sent the information sheet for the study and asked what dates they would be available to take part. Once a suitable date had been arranged participants were provided the link to the online consent and gaming habits questionnaire (used in phase 1 and 2) which they had to fill out prior to commencement of their reflexive photography

week. Out of a total of 93 participants from the phase 1 narrative survey and phase 2 survey, five went on to arrange an interview and sign up.

Due to the low response rate, a second round of recruitment was carried out using Facebook and Twitter. On Facebook the advert was posted to the OU Research Students, OU Students Gaming Club and Historical Game Studies Network. On Twitter hashtags included #games, #videogames and #pcgaming. Due to the low number of female participants, recruitment was also targeted at female gaming and tech groups such as #womenintech, #girlswhocode and #girlgamers. The advert was tailored to include those who may have felt they are not creative, instead focusing on trialling the reflexive photography method in the context of player experience. An online recruitment survey was set up where potential participants could read about the study, download the information sheet and provide their details if they wished to take part. 11 participants in total filled in the recruitment survey and four went on to take part, taking the total number of participants to nine.

### 6.1.4 Participant Sample

The study recruited 6 males, 2 females and 1 nonbinary person. Ages ranged from 22-38, with the median age being 32 ($M$ = 31.9, $SD$ = 4.9). Participants came from a range of nationalities which were 4 American, 2 British, 1 Canadian, 1 Maltese and 1 Slovakian.

Participants played digital games between 4 and 7 days a week with the median being 5 ($M$ = 5, $SD$ = 1.3) and spent between 1 and 5 hours a day playing with the median being 3 ($M$ = 2.8, $SD$ = 1.2). Participants played a range of digital games, both offline and online across various gaming mediums including PC, console, handheld and mobile phone. Offline games included RPG's such as *Xenoblade Chronicles 2* (Monolith Soft, 2017), action/adventure games such as *Red Dead Redemption 2* (Rockstar Games, 2018), puzzle games such as *Tetris Effect* (Monstars Inc. & Resonair, 2018) and sports games such as *Party Golf* (Giant Margarita, 2016). Online games included *Minecraft* (Mojang, 2011), *Final Fantasy XIV* (Square Enix, 2010), *Call of Duty: Black Ops 4* (Treyarch, 2018) and *Ring of Elysium* (Tencent Games, 2018). In terms of how participants identified as gamers; 2 identified as hardcore, 6 moderate and 1 casual.

### 6.1.5 Data Collection

Data was collected via two mediums: images (in the form of the screenshots) and audio data (in the form of the interviews). Participants sent the image data to the principal researcher via email prior to their interview. In addition to the three screenshots participants were to select to discuss in the interview, one participant captured additional images which they sent in to be included in the analysis. Interview data was collected over Skype using Amolto Call Recorder for Skype. Audio data was then sent for transcription via the Open University's transcription service.

### 6.1.6 Data Analysis

Data analysis was carried out using NVivo 11. A hybrid thematic approach (Braun & Clarke, 2006, p.6) to analysis was taken, using both deductive and inductive phases (Swain, 2018). This approach was selected as the research question had arisen out of Phase 1 findings on design affordances for creativity, and hence, a pre-existing thematic framework was available in which to initially deductively code data. However, the purpose of this study was to both confirm and elaborate on this framework by inductively identifying additional sub-themes which related to design elements which promoted or hindered player creativity.

Thus, for the deductive phase of analysis, the framework from Phase 1 was used to initially code data. The pre-existing lower-level theme of *Design Affordances* was used to categorise aspects of game design and mechanics which facilitated or inhibited player creativity. This included the subthemes of *freedom of play*, *environment*, *tools*, *replayability*, *avatar* and *creation* (see section 4.2.5 for theme descriptors).

For the inductive phase of analysis in total three iterations were carried out to refine the existing framework and identify further relevant themes. Inductive themes were identified according to their fundamentality and frequency of occurrence within the dataset (Adams et al., 2008). In this way, additional themes were identified which related closely to the research question (e.g. the particular elements of game design and mechanics which affected player creativity).

## 6.2 Findings & Discussion

In relation to *RQ3: what specific game design affordances contribute to player creativity?,* eight main affordances were identified which contributed to player creativity: *degree of flexibility, narrative, tools, content creation, environment & AI, avatar, progression* and *replayability & updates*. In this section the findings will be presented and discussed in light of the literature. Finally, a conclusion section will coalesce the main points from the discussions.

### 6.2.1 Overview of Design Affordances Themes

The refined design affordance themes included eight main themes encompassing further sub-themes. Sub-themes were developed inductively with *RQ3* in mind. Participants often referred to aspects of games which helped them, or hindered them in being creative, and as such, findings will be outlined in relation to both facilitators and inhibitors of creativity. In addition, it was found that many aspects of game design could act as both facilitators and inhibitors depending on the participant's viewpoints and motivations for play.

Originally, *Design Affordances* was a lower-level theme identified in Phase 1 which consisted of six sub-themes: *freedom of play*, *environment*, *tools*, *replayability*, *avatar* and *creation*. As the goal of phase 1 had not been to extensively focus on the design aspect of games, but instead provide an exploration of creativity in digital games, the themes provided an initial glimpse into the particular design elements which contributed to creative player behaviour. For Phase 3, which specifically focused on exploring how the design of games contribute to creativity, the initial sub-themes from *design affordances* were taken as deductive lower-level themes (i.e. a way of initially categorising the data), and inductively refined further into additional sub-themes. As part of the analysis, *freedom of play* was renamed *degree of flexibility* to encompass the overall structure of a game (e.g. open world or linear orientated gameplay, multiple ways to complete challenges). Furthermore, the original theme of *creation* was renamed to *content creation* as it was concerned solely with the creation of in-game content as opposed to the creation of strategic forms of play. Through induction, two further themes were added: *narrative* and *progression*. See table 24 for an overview. Individual theme descriptors are provided in the following sections.

**Design Affordance Themes**

| **Main theme** | **Sub-themes** | **Descriptor** |
|---|---|---|
| Degree of Flexibility (previously Freedom of Play) | Player Trajectories<br>Linear<br>Task Flexibility | Creativity related to the overall game structure (e.g. open versus linear games) and scope for alternative routes of play. |
| Narrative (new theme) | Story<br>Choices<br>Personal Narrative | Creative engagement with the game's narrative – either directly within the game such as exploring dialogue choices, and around the game in terms of affective elements and the use of narrative aspects in the creation of personal narratives. |
| Tools | Items & Abilities<br>Movement | Game variables usually directly related to gameplay progression such as items, abilities and movements. |
| Content Creation (previously Creation) | Objects, Levels & Maps<br>Interface<br>Mods | Creation of game content such as objects, levels and images (usually aesthetic and not directly related to game progression). Additionally, options for playing with mods and importing own media. |
| Environment | Exploration & Interaction<br>Aesthetics & Sound<br>AI | Environmental aspects such as graphical realism, opportunities for environmental interaction, opportunities for exploration, synchronisation of sound, environment and player actions and realism of AI behaviour. |
| Avatar | Appearance<br>Emotes & Voice | Avatar appearance and customisation of emotes and voice. |
| Progression (new theme) | Challenges<br>Paid Features & Unlockables | Progression in the game such as challenge versus skill balance, pay-to-win features versus pay-to-look good features, hints at appropriate times and variety of achievements to contribute to sense of progression. |

| | | |
|---|---|---|
| Replayability | Updates<br>Developer Events | Creativity in relation to refreshing the gameplay experience such as downloadable content which adds to the existing narrative, patches and updates which remedy imbalance issues, and creative events instigated by the developers. |

*Table 24: Design Affordances Theme Overview*

### 6.2.2 Degree of Flexibility

*Degree of flexibility* was the most frequently referenced theme – something which was also echoed in the findings from Phase 1. *Degree of flexibility* encompassed affordances in terms of how the player can choose to play, and how much freedom there was to test the boundaries imposed by developers. See table 25 for sub-theme descriptors.

| **Degree of flexibility Sub-themes** | **Theme Descriptors** |
|---|---|
| Player Trajectories | Includes opportunities for choosing different routes/modes of play and opportunities for engaging in sidequests and minigames. |
| Linear | Includes instances where a player has been restricted to one route/mode of play – however, not always with negative implications. |
| Task Flexibility | Includes opportunities for variation in how tasks/challenges can be completed. |

*Table 25: Degree of Flexibility Sub-Theme Descriptors*

#### 6.2.2.1 Findings

*Player Trajectories* included instances where participants mentioned games which allowed them to forge their own path and define the route of play, hence facilitating creativity. This often related to RPG style games where players can choose what type of character they wish to play. Four participants referenced games which allowed them to alter their playable character's abilities and statistics enabling them to choose their own play trajectories. One participant captured the stats screen from *Fallout: New Vegas* (Obsidian, 2010) and commented:

Male, 28


**Caption:** A screenshot of my PipBoy from *Fallout: New Vegas* with my character's stats.

*Figure 16: Degree of Flexibility Screenshot 1*

> "S*o Fallout in a sense is a RPG where you can put points into various different skills…you can points into certain skills that you can take, depending on your playstyle. So in this case, the way you assign your points, gives you, lends well to different playstyles, so for example if you want to be really sneaky, or if you prefer using guns or explosives and that sort of thing. So obviously I find that to be a particularly good creative outlet in the sense that you're not limited to one way of playing. You're free to play in any way you like, including really weird combinations."* – Male, 28

In addition to customisable character stats, which affected what playstyle was used, two participants also mentioned games that allowed them to engage in different game modes as facilitators of creativity. Both participants referenced screenshots they had taken of the arcade games *Party Golf* (Giant Margarita, 2016) and *Tetris Effect* (Monstars Inc. & Resonair, 2018) which provided additional modes of play where they could take a break from playing the main campaign. As one participant put it, referencing *Tetris Effect* (Monstars Inc. & Resonair, 2018):

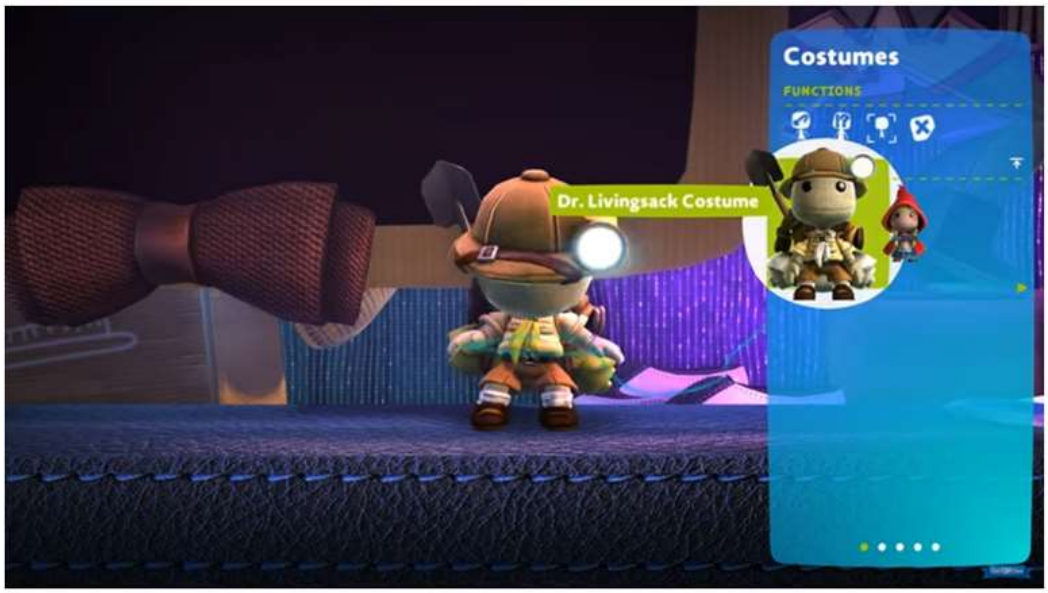
> *"There's these different aspects and stuff of it and it's not just play the main campaign, it's, do you want to go into a chill out thing, do you want to go into the hardcore challenges…or do you want to do one of these ones that's a bit more puzzle-y and…because there's slightly different ways of playing it that give you slightly, you can exercise slightly different things or, like I said, I can test out ideas in a different way or I don't have to feel like I'm failing, because it's like, oh if I can't get game over then it doesn't really matter…and so having that kind of training thing I think."* – Non-binary, 35

They also mentioned that different game modes can be used to help improve performance in the main campaign, essentially acting as a training method to test out new ideas. Another participant (male, 38) captured a screenshot from *Party Golf* (Giant Margarita, 2016) and stated that unlike normal golf which has a strict set of rules, the game allowed far more freedom in terms of how to play with its variety of customisable levels, balls and modes – so much so that it eventually became something very different to the traditional game of golf:

> "*Even though the game is called Party Golf, you get so far away from golf it stops being closely resembled as golf. The fact that your ball can be a banana or you can have power-ups and you can have multiple holes to shoot at or you have to go through certain checkpoints. The expanse is massive really. You can do so many different things and as I say it stops being close to golf at certain points. So [I was] trying to sort of show the diversity of the options mean that you can be very creative; still within the realms of it's a ball that has to be hit, but that's about it. That is the only thing that defines every level that you can create. You've got a ball of some shape or form and it has to make it to somewhere else on the map."* – Male, 38

Another facilitator for creativity mentioned in *player trajectories* regarded sandbox style games such as *Little Big Planet* (Media Molecule, 2008) and *Stardew Valley* (ConcernedApe, 2016), which allow players to do almost anything they wanted. As one player illustrated with his screenshot and commentary:

Male, 38




**Caption:** Customising 'Sackboy' in Little Big Planet 3

**Any additional comments**: Little Big Planet allows for the player to be very creative from customising the appearance of your character (above) to designing the playable levels for you to play. You can also upload your levels for anyone else on the internet with the game to play. The objects available range in their thousands. Unlike other games you can actually use your own images as items either by importing them from a USB stick or using a web cam.

*Figure 17: Degree of Flexibility Screenshot 2*

> *"In terms of creative input with a game I thought LittleBigPlanet is probably the pinnacle for me because you can do pretty much anything you want in terms of a platform game. It's like a sandbox environment really. So you can create the levels how you want them, the characters can interact in different ways, you can change the appearance of things…And I think that allows people to be quite free; very few boundaries effectively. And the premise of the game then is, it opens up lots of possibilities."* – Male, 38

Not only was the game designed as a sandbox environment with few ludic restrictions, it was also possible to import images to be used in the creation of unique objects (discussed further in *Content Creation*). In this way the game had been designed to not only include objects, items and levels created by developers, but also afforded players the opportunity to become developers themselves.

Within the *linearity* category participants mentioned games that were more restrictive in terms of the route of progression within the game or what alternative strategies they could use to overcome challenges. The majority of the examples in this theme discussed linearity as an inhibitor to creativity. One participant captured *Call of Duty: Black Ops 4* (Treyarch, 2018) and stated that he felt there was limited flexibility in terms of what tactics he could use. He relied on tactics he had used whilst serving in the U.S. army, however, he felt the game lacked the

complexity of a real-life military battle.

> *"So it lacks real life tactical elements. So the first thing is it's kind of absurd a person would drop a hail fire missile on three individuals. I have never seen that happen before, so I think that kind of dumb. I would say it's not a creative part; it's a common knowledge that becomes a basic instinct. So you keep shooting at that, I keep shooting at that one place. That's my basic instinct if it happened in real life. Well I should first run for cover but shoot back for is the best thing"* – Male, 22

Similarly, creativity could be inhibited due to the standardisation of the gameplay, leading to a more linear experience. One participant noted that there is a balance that developers have to maintain between the amount of choices a game offers and the audience they cater for. It may be impossible in some situations to offer boundless choices and complete player freedom, especially in the case of online games where there is such a diverse range of players. However, as stated in relation to *Final Fantasy XIV* (Square Enix, 2010), a more "polished" experience lacks the flexibility to accommodate other forms of play such as role-playing:

Male, 30


**Caption:** Reviewing Main Story Quest cutscenes

*Figure 18: Degree of Flexibility Screenshot 3*

> *"We're [the developers] going to make, standardise what kind of experience you have, the shots and the environments are framed in a way to lead you. You have a limited number of choices you can make, there's a little bit of a correct way to do it. But that experience is polished very finely. So it will work well, it will be smooth, it will play out the way that the developers want it to…So I can understand why they do this, but I definitely am the sort of person who wants more freedom to really role play the character and be all like, you know, this is just not, I just wouldn't do this, I would do something totally different."* – Male, 30

Other ways in which linearity in games inhibited player creativity were mentioned in relation to the composition of team members in RPGs. One participant (male, 28) made the distinction between *Final Fantasy X* (Squaresoft, 2001) where he could switch his characters and choose his team early on in the game, and *Breath of Fire* (Capcom, 2001) where he was restricted for a larger part of the game with just a small number of characters with no options for team composition.

Another participant also described how one game, *Alien: Isolation* (Creative Assembly, 2014), gave the semblance of freedom initially where there were "always places to hide, and [it] is about finding the best place to hide and using the environment and scanner to figure out all [the] different paths through a level" (male, 35). However, he soon found this rather constraining as it only "looked" like there were many places to hide, but in reality it seemed futile as the alien always checked these areas rendering them essentially useless for hiding.

Finally, the distinction was made between games which allowed achievements to be completed in numerous ways (further discussed in *task flexibility*), and games where such achievements could only be completed in a more linear fashion. For example, in the games *Uncharted 4: A Thief's End* (Naughty Dog, 2016) and *Uncharted 4: The Lost Legacy* (Naughty Dog, 2017), there is an achievement for climbing to the highest point in the environment. However, "the game doesn't really have innovative ways that you can go up to the top of it. You have to follow the set path." (female, 36).

While in more *linear* games the "player is restricted in terms of their creativity if they wanted to make something…[there is] creativity that goes into the design plot of the game" (female, 31) - something which is echoed in more traditional forms of media such as film, where the onus is on creating a story which takes the viewer from the start of the film to the end. However, even with a strong linear narrative, there was scope for creativity on the player side in terms of how the experience was interpreted (further discussed in *Narrative: story*).

In *task flexibility*, participants noted games that allowed them to complete tasks or challenges in multiple different ways. This flexibility was referenced across multiple types of games, including puzzle, RPG and first person. For example, one participant referenced *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) as allowing her to accomplish game achievements in a variety of ways.

Female, 36


**Caption:** In this picture, I was attempting to find a new way to complete an achievement I'd accomplished three times before. I'd spent a while trying to find new hills to slide down.

**Any additional comments:** I view this as a puzzle solving type of creativity. While not required by the game, I self-imposed the challenge on myself.

*Figure 19: Degree of Flexibility Screenshot 4*

> *"In The Witcher 3, because it's such an open world and such vast terrain there's actually multiple places so it doesn't hamper you and constrict you to one place. It actually allows you to pick where you're going to do it and how you're going to do it and why you're going to do it. So I think the game enables that first of all because it's a built in mechanic and then second of all because the landscape is built so that you can be creative in how you achieve the sort of static goal."* – Female, 36

By providing multiple ways in which the achievement could be completed, the game allowed her to create additional challenges involving finding different locations that would work for the achievement.

Other facilitators of creativity in terms of *task flexibility* included being able to tackle situations and enemies in multiple different ways. As one participant in his screenshot of *The Darkness II* (Digital Extremes, 2012) stated, there were "a million different ways to beat any of the particular encounters because there's just so many different things you can do to enemies" (male, 35). Another participant mentioned *Pokemon Red* (Game Freak, 1996), which allowed him to be creative in terms of the combinations of Pokemon he used in each battle: "with 150 Pokemon the odds are that you can customise your party much more, you have more combinations of things you can do" (male, 28).

While *task flexibility* was frequently mentioned in relation to open-world and RPG games, it was also referenced in relation to puzzles games such as *Thomas Was Alone* (Bithell Games,

2012). Here, the player is required to use different combinations of blocks, each with their own unique abilities, to reach the end point of the level.


*Figure 20: Degree of Flexibility Screenshot 5*

> *"You have a lot of space to play with the combinations of the different blocks. Like you know that you need to get from A to B and you can always know where you're supposed to go, but you don't know how to get there necessarily…But the space that these three [blocks] are in, it's just this little space that's surrounded by the three or four walls that are nearby. That space, I was thinking of as physical space allows you to play with the combinations of the blocks and like you know you're going to get them up there. How do you do it? Well, here is a little, you know, a little field, a little space, a little room, or a little bunch where you can just put possibilities, combine possibilities and play around and try and figure how to get things there."*
> - Male, 35

The participant notes that the game provides a certain amount of physical space in which such combinations can be realised, allowing him to experiment and combine different blocks. While this may be more unique to games where space is an explicit focus of a game goal (e.g. *Thomas Was Alone* is a 2D platform game where the level goal is about moving from one side of the map to the other), it does suggest insight into how space, both virtually in the form of the game world, and abstractly in relation to the combination of game variables can act as a scaffold and, hence, facilitate player creativity.

#### 6.2.2.2 Discussion

The theme of *degree of flexibility* related predominantly to how games were structured (i.e. open versus linear). In *player trajectories* a key point mentioned by several participants was being able

to define their own route through the game. One way in which games could support this was by allowing players to alter various character variables (e.g. stamina, strength, weapon levels), which dictated how they would play. Using Cardona-Rivera and Young's (2013) Cognitive Theory of Affordances for Games, the ability to alter character statistics would act as a real affordance which is implemented through the integrated actionable mechanics of adding or decreasing points on the statistics screen. The outcome of such alteration, however, is synonymous with the perceived affordance of the player (e.g. the player perceives that such alterations allow them to then play in a specific way). Similarly, from Kaptelinin and Nardi's (2012) mediated action perspective, the interaction between the character statistics screen and the player would constitute a handling affordance in that it presents an opportunity to interact with the game directly, and the result of such action would constitute an effecter affordance where the effect of such player actions alter elements of the game world (e.g. enemies may be dispatched of by using stealth as opposed to bombs).

Both *player trajectories* and *task flexibility* were usually mentioned in relation to open-world games in which there was a looser ludic structure and players were able to explore and define their route of play at will. According to Aarseth (2012) games contain two types of space – the ludic space and the extra-ludic space. The ludic space relates to the area which is playable, while the latter refers to the surrounding space where the player cannot explore. Depending on the type of game, the two types of space vary, e.g. in a linearly structured game the majority of space is extra-ludic, whereas in an open-world game the opposite would be true. As the majority of participants mentioned instances in *player trajectories* and *task flexibility* in relation to open-world games, one interpretation could be that extending the ludic space available to players provides greater opportunities for creative action. This is not solely in relation to being free to define the route of play, but also in relation to *how* the gameplay is realised in terms of multiple ways to complete challenges. For instance, the participant who documented finding different locations to complete the sliding achievement in *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) required an extended area of ludic space (i.e. the open-world structure) containing multiple locations (i.e. mountains, hills) that afforded the slide action.

Another way of looking at affordances for *player trajectories* and *task flexibility* is in relation to the concept of the "possibility space" (Järvinen, 2008; Wright, 2006), which begins in a well-defined state (i.e. the player initially has to complete certain tasks to become accustomed to the game) before progressing to an ill-defined state, where there are multiple routes of play and ways to achieve goals. The larger the possibility space, providing for greater *task flexibility* or a range of *player trajectories*, the greater opportunity for strategy creation where players can develop their creative abilities (Järvinen, 2008).

Finally, the sub-theme of *linearity* pointed to games where the route of progression was restrictive and task flexibility was limited. The majority of participants referenced the sub-theme of *linear* in relation to instances where their creativity had been limited, something which is synonymous with Järvinen's (2008) argument that when the "possibility space" (i.e. the space for imaginiation) is restricted through lack of choices and actions then the player's creativity will be reduced. For example, this can be illustrated by the participant who mentioned being able to complete achievements in multiple ways (larger possibility space) in *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) and being restricted to where the achievement could be completed (smaller possibility space) in *Uncharted 4* (Naughty Dog, 2016, 2017). Furthermore, games needed to have a genuine possibility space, and not give the semblance of having a larger possibility space – or in other words, the perceived affordances of the player needed to match up to the real affordances the game offered (Cardona-Rivera & Young, 2013) as was illustrated by one participant in *Alien: Isolation* (Creative Assembly, 2014) where there was the appearance of multiple hiding spots, however, very few were actually viable.

While *linearity* was referenced often in relation to instances where creativity had been constrained, linear games were still seen as creative, either in terms of developer input or in relation to how the player interprets the experience. This sub-theme relates back the idea that many games are becoming more accepted as art forms in their own right (Bogost, 2011; Clarke & Mitchell, 2007; Smithsonian Institute, 2012). This view is discussed in greater detail in section 4.3.2.3.

### *6*.2.3 Narrative

References in *narrative* referred to opportunities for creative engagement with the game's narrative and were usually more general descriptions of creative behaviour (i.e. did not always have positive/negative connotations). Table 26 contains sub-theme descriptors.

| **Narrative Sub-theme** | **Descriptor** |
|---|---|
| Story | The overall story of the game and how it affects the gaming experience. |
| Choices | Relates to choice-based narratives where player has freedom to choose over several dialogue options. |
| Personal Narrative | Relates to game narratives which provide scope for players to create their own stories. |

*Table 26*: *Narrative Sub-Theme Descriptors*

### 6.2.3.1 Findings

Within *story,* participants referenced how the game narrative unfolded in different ways, sometimes affecting them on an emotional level (relating to the conceptualisation of creativity as affective change). One participant captured two images of instances where the story of the game had created a lasting impact on her, prompting reflection of the emotional themes depicted in the game. In her screenshot of *Final Fantasy XV* (Square Enix, 2018) she explains how a particular scene made her consider the effects games can have on people, and how she then further explores such themes: "I have been exploring these themes through game imagery, narrative and music" (female, 31).

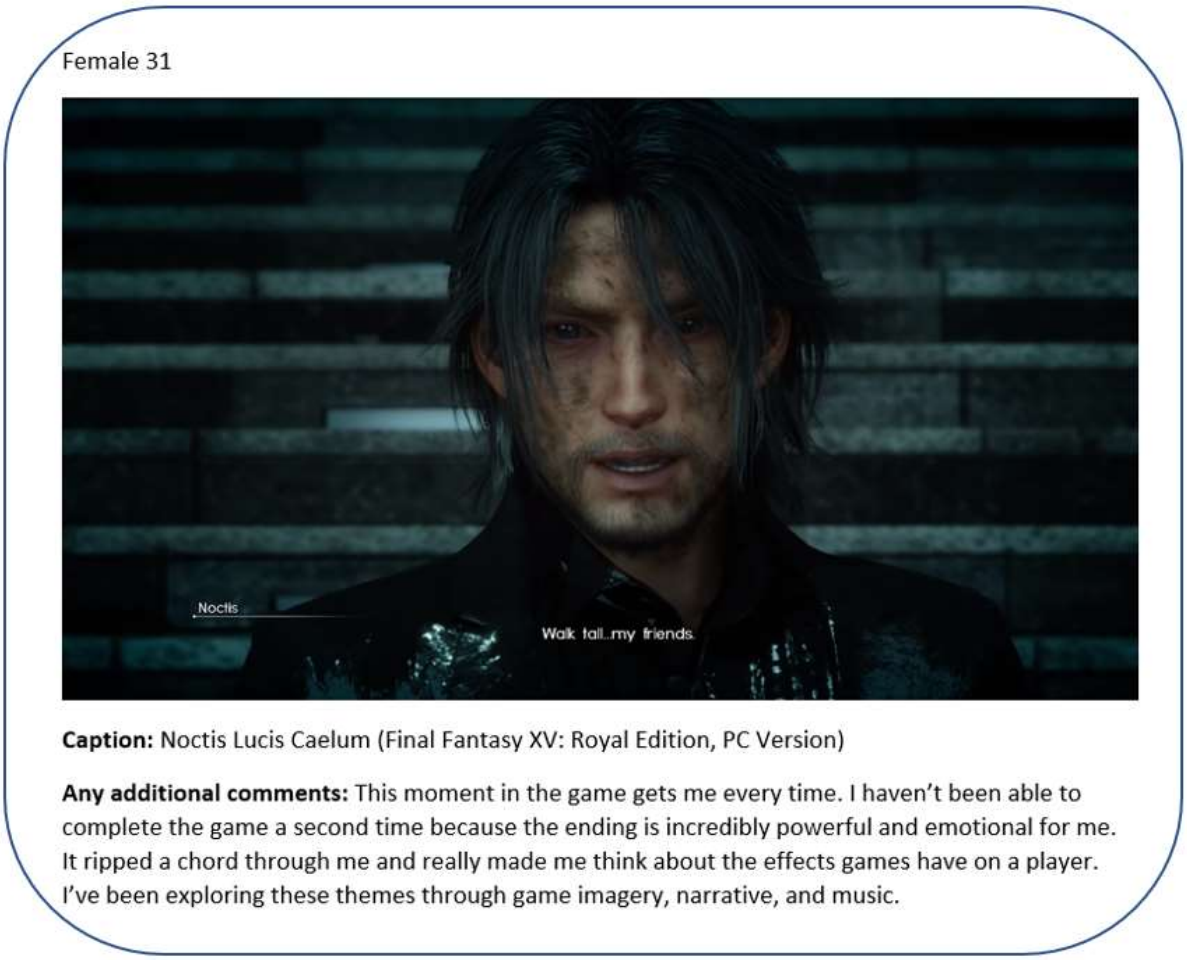



*Figure 21: Narrative Screenshot 1*

Another participant captured the MMORPG *Fallout 76* (Bethesda Game Studios, 2018) which, like most MMORPGs, did not have a narrator (as is common in offline games). Instead the narrative was realised through interaction with objects and the environment.

> *"So the story itself is very interesting. So it has a lot of background to it…there's no non-player character to narrate the story. Everybody is a character that go through the story. No one's going to tell you to do this, this and this, and then see the story. You're going to pick up the story from the dead people…Pick up the story from their record, pick up the people from the environment they was in."* – Male, 22

He also notes that while he loves the game as it allows him to unravel the narrative on his own, he felt that creativity in this context is more in the hands of the developer than the player as there was no dialogue options to customise the story. However, as the story was realised through "putting the pieces together", it left certain areas of the narrative to question, allowing him to fill in the blanks himself (discussed further in *personal narrative).* In this way, while the lack of dialogue options meant the linear narrative could act as an inhibitor for creativity, the blank canvas it left acted as a facilitator for creativity in terms of constructing the story through direct interaction with the game environment.

The impact in-game characters had on the overall narrative of the game was also mentioned. One participant who took two screenshots of *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) said "I would say basically Witcher 3's strength as a game is in writing characters that you care about and then giving you the details and they have a certain behaviour pattern" (female, 36). In games, such as the *Witcher 3: Wild Hunt,* which have a paidiac game structure (the player is able to explore an open game world and engage in a multitude of side-quests and stories), the strength of well written character personalities provides a constant structure to the looser overall game narrative. By providing a strong narrative, the game may provide content for subsequent creative behaviour around the game, such as in the case of one participant who referenced "making buttons or posters or character art" (female, 31).

In *choices* participants referenced instances where choice-based game narratives had impacted their creativity. One participant referenced *Final Fantasy XIV* (Square Enix, 2010) as one game which he felt lacked "meaningful choices". He states that there is no branching story, however, "you do get these little opportunities to have a little bit of flavour of like what kind of hero is your hero" (male, 30).

Male, 30


**Caption:** Dialogue choices

**Any additional comments:** These dialogue choices do pretty much nothing. The non-player characters ("NPCs") in the conversation react slightly differently, with maybe one or two lines of dialogues differing based on your choice, but the quest always ends up progressing the same way, and the player always has to the same thing to complete it. Oftentimes, the dialogue choice is, as here, between agreeing enthusiastically and agreeing reluctantly; there's no option to disagree or suggest some different course of action.

*Figure 22: Narrative Screenshot 2*

While there are no choices that can alter the story of the game, the player still has some creativity with regard to the personality of their avatar and has an opportunity to engage critically with the narrative. The participant above noted that MMORPGs such as *Final Fantasy XIV* (Square Enix, 2010) may prove difficult to implement large scale branching choices which alter the overall game as there are so many players, each with different motivations and playstyles. He also recalled that the game community had previously voiced opinion over the linear main quest in the first base game, and to address this the developers had added in these choices, usually "at points that they knew were more controversial, or where there was room for you to have differing feelings" (male, 30). In this way, while still standardising the game experience, the developers were attempting to account for the different feelings and motivations of the players, thus providing creative scope, although limited, for exploring the game narrative.

Games which lacked choices that could change the overall course of the game were contrasted with games that were heavily associated with meaningful choices such as the *Dragon Age* series (Bioware, 2009, 2011, 2014). These games still have a linear main story, but the player is afforded opportunities to make decisions that affect the key components of the narrative. Another participant, referencing *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) spoke of the creativity involved in discovering new choices within the game:

> *"The game asks you to pick from their choices and then sometimes depending on the order you do interactions or the steps you take to get there it'll unlock new ones and it rewards you for that sort of creativity…the game already has a certain amount of encouragement in making you make your own decisions and how you want the story to play out."* – Female, 36

While creativity was facilitated in terms of being given the option to shape the overall story, in *personal narrative* participants spoke of instances where they created their own story, or version of events, out of the main narrative of the game. The same participant who referenced the creativity involved in making new decisions within *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015), also captured a screenshot of an instance when she didn't like any of the choices offered, and instead preferred to construct her own imagined response:

Female, 36


**Caption:** I was making up my own dialogue to this.

**Any additional comments:** Having played this game many times, I know how the dialogue tends to go. And I really don't agree with all of it. So I was making up my own dialogue over this. Something much less complimentary to reflect my true opinion of the dazzling woman's awful taste in perfume and her young teen-ish obsession with black and white garb.

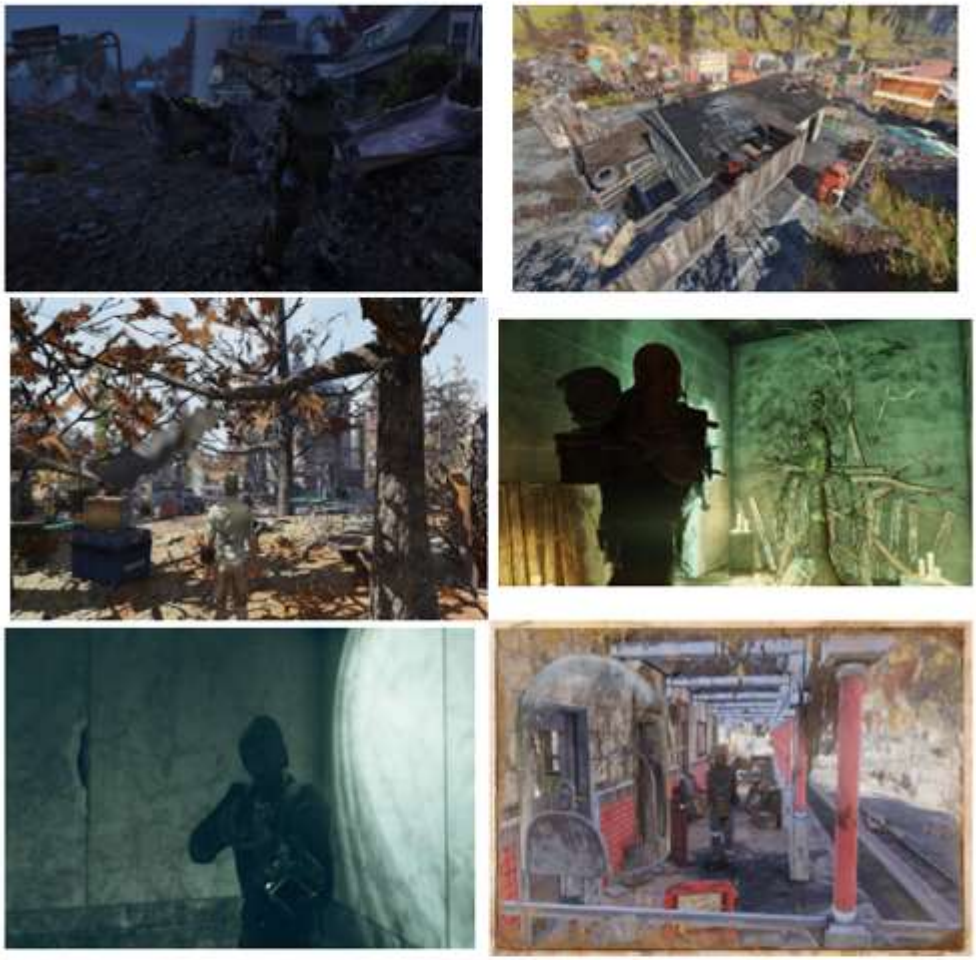
*Figure 23: Narrative Screenshot 3*

> *"I was taking the opportunity sort of to talk back to the game and tell her that her perfume sucked. She might look good but her perfume sucked. So I kind of, that's not something necessarily, I mean it's something that spawns out of the game. But it was sort of my, I was making my own dialogue choices even though the game only allowed you a couple of ones."* – Female, 36

The same participant also referenced RPGs where there is a silent protagonist, such as in *Dragon Age: Origins* (Bioware, 2009) as being conducive to creating personal narratives as "you have to make up what they said" (female, 36), and in these instances she may also write down her own responses. A similar view was also stated by another participant who stated that games such as *The Elder Scrolls V: Skyrim* (Bethesda, 2011) provided more "creative room" (male, 30), as there was no voiced protagonist so the player needed to "bring" more to the story.

Another participant created a collage of images from *Fallout 76* (Bethesda Game Studios, 2018) which allowed him to construct a story of his gaming experience:

Male, 22



**Caption:** Screenshots are taken by using Photomode of the game Fallout 76 by Bethesda.

**Additional Comments:** Upper left: me slaying a ScorchedBeast, a very difficult giant monster within the game

Upper right: Me taking a rest from building an add on stairs and defensive system. It took me almost fifteen minutes to align the platform to perfectly fit in with the building.

Middle left: my small camp that has been very cozy to me.

Middle right: A creepy effigy that I found in the basement of a very ordinary building within the wasteland.

Lower Left: Picture of my character in the early stage of the game, an ordinary person who just got out his comfort zone (vault 76)

Bottom right: My character slowly becoming a part of the wasteland, slowly blending in.

*Figure 24: Narrative Screenshot 4*

*"Fallout and the previous Fallout, they all have a story, and this one I get to make a story myself…We have a lot of space to make stories as we go. And a lot of people really hate the game for it. The reviews have been very bad. But yeah, there's an empty space, there's no narration. There's a going on story, but there's also space for your own story to be implemented to it. I think that's the most creative aspect of it, beside the photo mode and the building system."* – Male, 22

In this sense, the game is a blank canvas upon which the player is free to construct their own narrative and role-play their character. Unlike games which are created predominantly for their strong stories such as the *Dragon Age* series (Bioware, 2009, 2011, 2014) and *The Witcher* series (CD Projekt Red, 2007, 2011, 2015), *Fallout 76* (Bethesda Game Studios, 2018) is "an empty space" without narration where the story is essentially the interaction between the player and how they choose to interpret the game, and not the interaction between the player and the narrative created by developers.

Finally, in a similar vein, another participant, in his screenshot of *Stardew Valley* (ConcernedApe, 2016) recalled himself and his friends creating a narrative within the game. The game is a sandbox design, allowing the player to engage with various non-playable characters (NPCs) as well as to build their own farm. In a cutscene, the game hints that there is a romance between two NPCs, and while not impacting on the narrative of this scene, the participant chose to walk behind the two NPCs, as if eavesdropping on their conversation. He later told this to his friends who found it a hilarious addition to the game narrative:

> *"So I have a screenshot of all three of us just standing behind them like this. So that again is the creation of narrative within the game. So OK the game doesn't really care what you're doing, but when you retell it to others, it's like OK cool, I didn't know you could do that sort of thing."* – Male, 28

In this way, he not only created an additional narrative (of himself eavesdropping on the two lovers' conversation), but also a shared narrative which his friends could also take part in.

#### 6.2.3.2 Discussion

The theme of *narrative* focused on the narrative structure of a game, and how such structure influences creativity. The majority of examples in *story* constituted participants enjoyment of well scripted game narratives. Both choice-based and linear narratives were referred to as prompting creativity. While in the interviews discussed here no reference was made to any affective change instigated through the story, the use of ambiguous storytelling has been argued to be a core component of emotional challenge in games (Cole et al., 2015); something which has been identified as contributing to creativity from a Mini C sense (Kaufman & Beghetto, 2009).

One participant referenced *Final Fantasy XV* (Square Enix, 2018) when detailing the lasting emotional effect the story had on her and how, subsequently, the effect of the experience facilitated creative behaviour outside of the game. Such creativity was captured in the Phase 1 theme of *Transferability: ideas* (see section 4.2.4) where ideas and inspiration from games are used in other areas of life and vice versa. While not an affordance in the more traditional sense, the scripted narrative of the game provided an emotional challenge (Bopp et al., 2018; Cole et al., 2015) that compelled her to explore further. Her account of reflecting on the gaming experience

suggests that in this way, the game acted as a mediator for further creative behaviour – something which can be illuminated by Kaptelinin and Nardi's (2012) concept of an aggregation affordance that relates to the combination of technology with other artefacts. Using the game narrative, music and imagery as a means to further explore emotional themes suggested a correlation with reflection which involves "looking for relationships between instances of experiences, consideration of alternative explanations and perspectives, as well as cycles of questioning, hypothesising and interpreting" (Mekler et al., 2018, p. 322).

While aspects of the designed *story* encouraged reflection and further exploration of various issues, in *personal narrative*, participants created their own stories from the game. It was mentioned by one participant that the lack of narration created a void which provided scope for him to fill in the blanks and create an alterbiography (Calleja, 2011). Similar to other instances, the game narrative acted as mediator for further creative action where he took screenshots of his character's experiences in the game and created a written script to go alongside them – although in this case the creative action was centered on his own *personal narrative* of the game, as opposed to reflecting on the experience of the designed *story*. In such games, the narrative unfolds as a direct interaction between the player and gameplay as opposed to the player and the scripted narrative.

While games such as *Fallout 76* (Bethesda Game Studios, 2018) that lack direct narration or voiced protagonists provide creative opportunities for players to create their own personal narrative and interpretation, games such as *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015), which focus on strong choice-based narratives also provided a means for players to be creative. Interpreting *choices,* using Hunicke et al.'s (2004) MDA framework (as detailed in 2.4.5), games which focus on a strong and structured story would have an overall aesthetic goal orientated towards "narrative" (i.e. the game as a narrative experience). The dynamics that contribute to how the aesthetic goal is created may encourage narrative exploration through interacting with non-playable characters. The mechanics of being able to select different dialogue *choices* would hence allow such dynamics to be realised. In this way the combination of aesthetic focus, dynamics and complementing mechanics would allow for the narrative exploration of the game.

Such narrative exploration can be realised through branching storylines that allow for different possible outcomes. Using Young and Cardona-Rivera's (2011) Model of Game Story Comprehension, narrative affordances comprise of narrative events which encourage players to envisage possible outcomes to the story. In relation to such choice-based narratives, player creativity is encouraged by providing a selection of possible outcomes - each of which may correspond differently to the players' current cognitive state. As was detailed by one participant refencing *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015), the creativity comes from not so much

envisaging the outcome of a particular choice, but by unlocking new and unexpected choices that further develop the narrative.

### 6.2.4 Tools

The main theme of *Tools* encompasses instances of creativity that were facilitated or restricted by the items, abilities and the range of movement made available to players. Tools was divided into the subthemes of *items & abilities* and *movements* (see table 27).

| **Tools**<br>**Sub-themes** | **Descriptor** |
|---|---|
| Items & Abilities | Variety of usable items at the player's disposal such as weapons. Variety of different abilities the player can use such as spells and combat actions. |
| Movement | Range of movements (e.g. running, jumping) available, including the use of other modes of transport such as vehicles. |

*Table 27: Tools Sub-Theme Descriptors*

#### 6.2.4.1 Findings

*Items & abilities* were often a pre-cursor for *Degree of Flexibility: task flexibility* as they allowed situations and challenges to be completed in different ways. One participant made reference to the amount of different game *items* that could be utilised. Referencing *The Darkness II* (Digital Extremes, 2012), one participant stated that the game gave the player hints at what items could be used by highlighting them in purple:

> *"There are other objects will be highlighted in purple, like car doors and lampposts and things the demon arms can pick up. But they'll use the car doors as shields. You can throw the lampposts and impale enemies."* - Male, 35

The multitude of items, each with different uses, was further complemented by the range of *abilities* afforded to the player. The game provided the player with "two demon arms" which both had unique abilities in addition to being able to pick up useable objects from the environment.

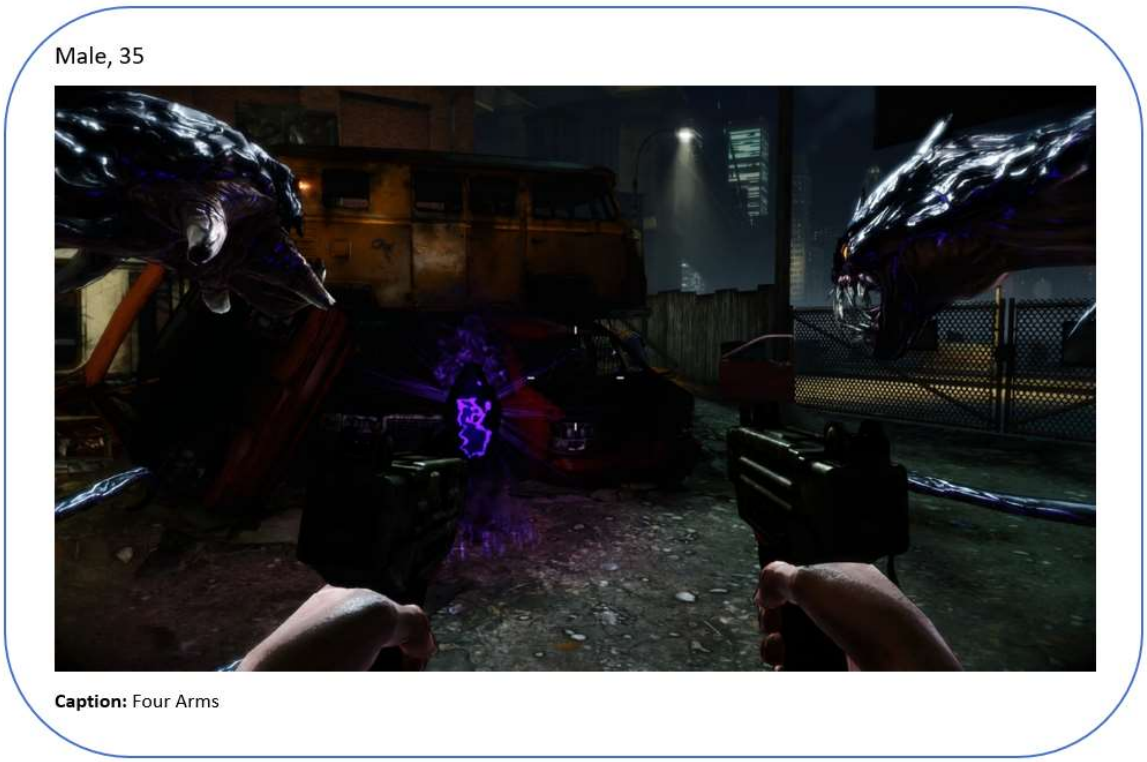



*Figure 25: Tools Screenshot 1*

However, the same participant also mentioned that while the player is afforded multiple ways to interact with, and utilise different objects and abilities, "the game starts to become repetitive: what initially seemed like a range of creative options to deal with firefights becomes very formulaic" (male, 35). This suggests that while, initially, the *items & abilities* afforded to the player facilitate creativity, once an optimal strategy has been established, there remained little in the way of introduction of new tools or alternative trajectories for dealing with firefights, thus inhibiting further creativity.

This was contrasted with the puzzle game *Thomas Was Alone* (Bithell Games, 2012) which provided the player with a set of *items & abilities* in addition to a range of *movements* (i.e. running, climbing, different modes of transport) which were constantly expanded upon as the game progressed. The same participant mentioned that he enjoyed "role-playing games a lot as you're constantly unlocking new abilities. Enemies are always getting harder" (male, 35). It appeared that it may not just be the number of different tools afforded to the player which facilitated creativity, but the rate at which they are introduced.

However, players were sometimes discouraged when *items & abilities* appeared to lack effectiveness. In *Alien: Isolation* (Creative Assembly, 2014) one participant mentioned that the different tools at the player's disposal seemed to have very little effect: "you have all these tools, but very few of them actually work on the most dangerous thing in the game" (male, 35). Thus, it may be a combination of the variety of tools and their effectiveness that is key to facilitating

creative behaviour (e.g. you can have a large amount of "gimmick" tools but none of them actually matter in terms of progressing in the game).

Several other participants also mentioned range of *movement* as being conducive to their creativity. One participant referenced *Ring of Elysium* (Tencent Games, 2018) as providing him with a simulation of swimming; something he could not do in real life: "they give me the ability to actually dive, because I cannot swim. I just jump in the sea and just start my adventure under the water" (male, 32). The ability of games to provide players with experience they would not normally have in real life was also echoed in what modes of transport were available as one participant recorded in his screenshot of *Ring of Elysium* (Tencent Games, 2018).

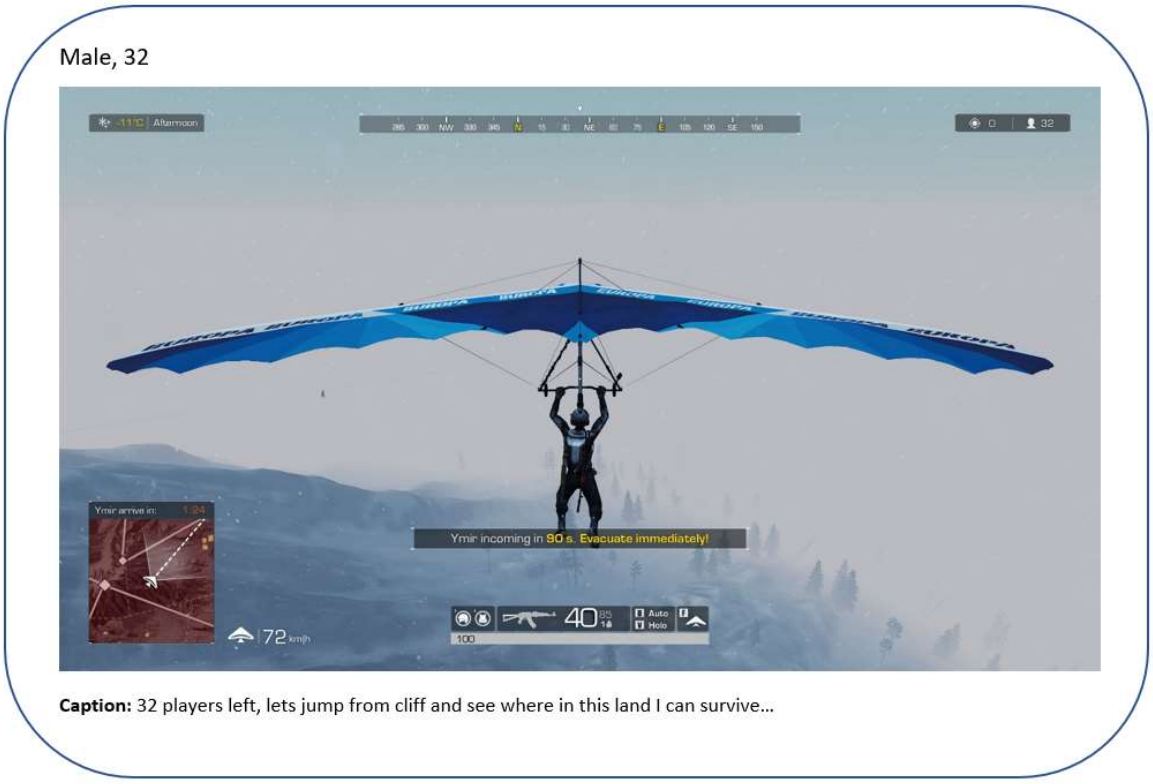



*Figure 26: Tools Screenshot 2*

> *"There was the glider which, I never glide before so for me there was, again, using something what I never used in my life. That was the creativity. So I think overall for me this game gives me the travel ability or the extremes which I couldn't try in real life and I can do it in the game."* - Male, 32

By providing alternative modes of transport such as gliders, as well as extended ranges of movement including swimming, players are able to explore the game world in ways which they do not have access to in their real lives. The same participant also noted that the game was also creative from the developer's side as they had been creative enough to implement such forms of transport in the game to allow players to experience the game in different forms (by air, by foot, underwater).

#### 6.2.4.2 Discussion

The variety of tools offered to players has been suggested to be a core design element of good games. For instance, according to the GameFlow model (Sweetser & Wyeth, 2005), players should feel a high level of control over their avatar's movements and interactions. In *items & abilities,* games that allowed for the use of multiple objects appeared to enable greater *task flexibility*. Going back to Cardona-Rivera and Young's (2013) cognitive theory of affordances for games, the design of usable *items* within the game world is advertised through feedback – the perceptual information implemented by developers to elicit accurate perceived affordances. The perceived affordance in this regard relates solely to the item as being interactable, the real affordance may differ in terms of what the item does. As illustrated by the earlier *Darkness II* example*,* some objects afford blocking by acting as shields (e.g. car doors) while others afford throwing (e.g. lampposts). *Abilities* complement *items* in that the latter realises the function of the former.

Another interpretation, using Linderoth's (2013) ecological approach to game affordances points to how players may be guided within the game through the use of exploratory affordances, (e.g. in this case, by drawing the player's attention to useable objects in the environment by highlighting them in purple). The player is then provided with choice as to whether they will interact with such objects further and through such interaction performatory actions are then realised (e.g. the item yields an affordance for a specific ability such as blocking or throwing). By providing a range of different interactable tools, players are able "to extend their capabilities and realize new affordances" (Linderoth, 2013, p. 6).

However, while games with a large variety of *items & abilities* allow for multiple combinations of such variables, it was also highlighted by participants that if they were all introduced early in the game it could lead to repetitive gameplay. This was contrasted with games such as *Thomas Was Alone* (Bithell Games, 2012) where new *items & abilities* and *movements* were introduced at regular intervals throughout the game, helping maintain motivation and scaffold the creation of new strategies. Similar conclusions were drawn by Herodotou et al. (2014) who found that while the introduction of new options, updates and expansions helps maintain player motivation, the game may turn repetitive once players are familiar with the game structure and choices. While Herodotou et al.'s (2014) study focused on online games, the rate at which new game variables are introduced in single player games may have a significant effect on whether the gameplay experience remains fresh or becomes a repetitive affair.

Finally, providing players with a diverse set of *movements* such as swimming, running and climbing was cited to facilitate player creativity both by allowing the game world to be explored by various different means and by providing a simulation of such as actions that were not possible in real-life. This was especially evident in openly structured games such as *Ring of Elysium*

(Tencent Games, 2018) where there was a large open world to explore, suggesting that the size of the ludic space may dictate what movement variables can be used to explore it (e.g. an open-world design may afford flying as a means of travel, whilst this may be harder to implement within a linearly structured game).

### 6.2.5 Environment

*Environment* covered instances where participants described creativity associated with interacting, exploring or viewing the game environment, as well as the realism of the creatures, NPCs and enemies which populated it. It was divided into the subthemes of *exploration & interaction, aesthetics & music* and *AI.* See table 28 for descriptors.

| **Environment Sub-themes** | **Descriptor** |
|---|---|
| Exploration & Interaction | Instances involving exploration, discovery and interaction with the environment. Environmental effects which impact gameplay |
| Aesthetics & Sound | Includes graphical elements such as artistic style and realism, and the synchronisation of game music with the environment and player actions. |
| AI | Realism of artificial intelligence such as enemy responses to player actions. |

*Table 28: Environment Sub-Theme Descriptors*

#### 6.2.5.1 Findings

In *exploration & interaction*, the most frequently mentioned aspect of the environment conducive to creativity was having the opportunity to explore and discover new areas. One participant in his screenshots of *Ring of Elysium* (Tencent Games, 2018) stated one of his main motivations was to explore the open-world and discover new places. He particularly enjoyed the fact that developers had taken the time to populate and detail underwater life, opening up a new avenue to explore: "for me it was the creativity…to find more aspects of the game, more things hidden in the game" (male, 31). Another participant captured *Xenoblade Chronicles 2* (Monolith Soft, 2017), which has an open-world design with "so many secrets, and there's so many places to go and discover" (female, 31).

Just as freedom to explore the environment and discover new things were referenced as facilitators of player creativity, some described how interaction with the environment could afford opportunities for creative problem-solving. One participant in his screenshot of *The*

*Darkness II* (Digital Extremes, 2012) highlighted the fact that gameplay was affected by environmental effects such as light which dictated which abilities the player could use, and what abilities were used by enemies. To combat this, the game allows the player some control over light and dark by being able to shoot light sources and the generators which power them. While having a light/dark game mechanics makes the game more challenging, it also forces the player to be more strategic in their actions:

> *"It's that tension between the freedom and the constraint, right. If it didn't have the light mechanic, if these games didn't have a light mechanic, then you've got no reason to hide…But then at the same time, when the constraints are imposed upon you then you have these new rules that you have to follow, you have these new rules you have to navigate. And within the rules you can push the boundaries. It maybe forces you to think a bit more. If the lights weren't there you could go anywhere, but the lights are there, so now all of a sudden I have to consider these things I didn't have to consider before. Where is the light coming from? Can I shoot that light out?...And that pushes you to think more. So with the constraint comes the requirement to think within the constraints, which feels good."* – Male, 35

The light/dark mechanics in *The Darkness II* (Digital Extremes, 2012) is contrasted with games such as *Dishonoured* (Arkane Studios, 2012) in which the only mechanics associated with light/darkness is stealth (going into the light breaks the stealth mode and enemies can see you). By providing a more complex light/dark mechanics (e.g. by allowing the player to use certain moves, control the light, and dictate how enemies will behave), *The Darkness II* may afford more environmental opportunities for creative behaviour.

In *aesthetics & sound,* one participant in her screenshot *of Xenoblade Chronicles 2* (Monolith Soft, 2017) mentioned that the aesthetic beauty of the game left her "awestruck". Her screenshot depicts the grandness of the game environment:

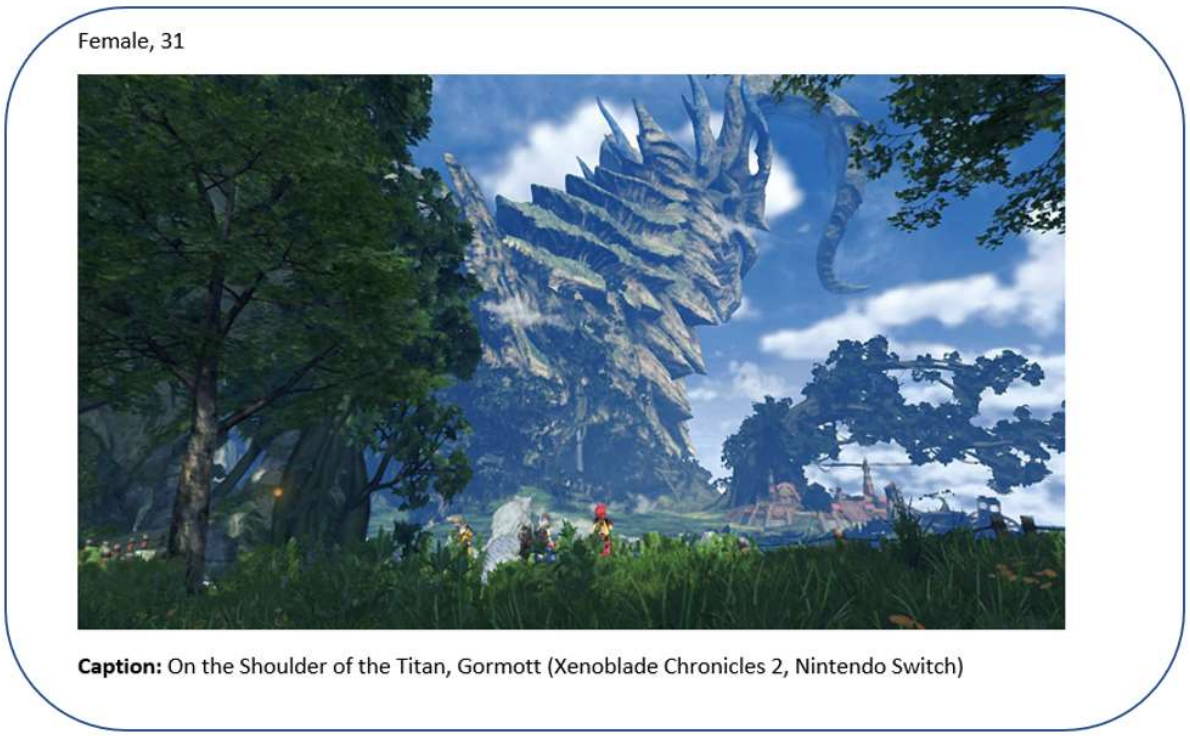



*Figure 27: Environment Screenshot 1*

> *"So I loved that place that I set the screenshot, and I set that up myself. So I zoomed my camera back, and I wanted, it was just taking a picture of the whole thing, because it's just aesthetically, it was absolutely beautiful."* – Female, 31

She talks about how the beauty of the game environment inspired her to "set up" her screenshot to capture the vista before her. Another participant who captured *Red Dead Redemption 2* (Rockstar Games, 2018) also mentioned that the aesthetic beauty of the game prompted her to deliberately set up her screenshot to capture what she later wished to use as inspiration in a story she was writing. In this way, creativity is facilitated both within the game in terms of setting the scene for the screenshot, and outside the game, in terms of providing inspiration for further creative behaviour.

In addition to beautiful aesthetics, the realism of the game environment also proved to be a facilitator in participant's creativity, with one participant in his screenshots of *Ring of Elysium* (Tencent Games, 2018) mentioning that the realism of the game, including aspects such as the physics system and realistic environmental sounds allowed him to "actually have that experience within the game" (male, 31) as opposed to games with "cartoon-ish" graphics which did not resemble reality.

The music within the game environment was also cited as a facilitator for player creativity, with one participant capturing *Tetris Effect* (Monstars Inc. & Resonair, 2018) in which

the player moves blocks to make various sounds in sync with the background music. However, they later noted that the harmony could be disrupted if a wrong move was made throwing the environment, the players moves and the music out of sync:


*Figure 28: Environment Screenshot 2*

> *"So it only becomes distracting when that whole thing was like broken and you're making stuff that don't match with anything else and then the background then just feels a bit too frantic, because I'm dropping blocks really quickly to try and fill holes and stuff and then you're playing out of time with the music and things like that…"* – Non-binary, 35

While the challenge of keeping the blocks in time with the music and environment was not a bad thing as "you're really into creating something and you're really in the that flow or the zone" (non-binary, 35), the participant noted that once things had been disrupted it was very difficult to get back on track and they usually had to start over. However, they state that it isn't necessarily the game which has stopped them from being creative, but instead their own ability "has snapped me out of that state and…there's nothing I can do to get that back" (non-binary, 35). In this case player motivation may play a mediating effect in terms of creativity – with the difficulty involved

in getting back into the game proving a demotivating factor which in turns inhibits player creativity. In essence, the synchronisation of music with the environment and player's moves facilitates creativity, but once these three things are no longer connected both motivation and creativity are inhibited.

Finally, realistic *AI* behaviour and responses to player's actions were also considered to be facilitators of creativity that can also add to the realism of the gaming experience. One participant in reference to his screenshot of *Alien: Isolation* (Creative Assembly, 2014) mentioned how the most dangerous enemy in the game (the alien) "hunts you and makes you feel hunted. It's really well done. It seems smart…it feels like its alive. It feels like it thinks" (male, 35). The more sophisticated AI behaviour meant that he approached the game differently – instead of charging in he had to think more about his actions and come up with ways to "play more cautiously, or sometimes take risks" (male, 35).

#### 6.2.5.2 Discussion

Many open-world titles provide a large ludic space for players to explore; something which can be linked back to the MDA framework (Hunicke et al., 2004), which states that games have different aesthetic goals, one of which being the goal of "discovery". In such games, there are many new locations to discover, and as one participant mentioned in relation to *Ring of Elysium* (Tencent Games, 2018), developers can go the extra mile to add details to the environment such as underwater life. In this way, the aesthetic of discovery is created through providing a large ludic space and encouraging players to discover and explore all areas of the game environment.

Interaction with the environment appeared to act as a gateway for further creative action and was cited as to afford opportunities for creative problem-solving. According to the GameFlow model (Sweetser & Wyeth, 2005), one way the game design element of control is facilitated is through providing environments where the impact of play can be directly observed such as the light/dark mechanics of *The Darkness II* (Digital Extremes, 2012) where certain abilities are only usable depending on light or darkness. By adding a new level of "constraint" to the game, the player is forced to be more strategic in their gameplay. Linderoth's (2013) ecological approach to games may illuminate how environments can be designed with creativity in mind through adding environmental effects and interactions. In line with Gibson's (1977) original concept of affordances, the ecological approach to games states that affordances are relative to the player – so some players may have a higher level or different stats, which would enable them to use a certain item. By adding environmental effects such as light/dark, this adds a new level to what the environment can afford players as certain tools may only be used in certain conditions. If those conditions are not present, then new strategies need to be created such as locating places to hide, or, engaging in actions that alter these environmental effects, such as shooting out the

lights. As Linderoth (2013) points out: “many of the actions a player engages in during game-play have a transformative aspect, in that they can create new opportunities for other actions” (Linderoth, 2013, p. 7). Through engaging in performatory actions such as shooting out the lights, the environmental effects alter to present new affordances for the player. In this way, “the player takes actions to create new affordances, not just to discover them through exploratory actions.” (Linderoth, 2013, p. 7).

While *exploration & interaction* was the predominant sub-theme referenced in relation to affordances for creativity, *aesthetics & sound* were cited as complementing the overall game experience and acting as facilitators for creativity on the macro level (e.g. around the game). In the example provided by one participant relating to *Red Dead Redemption 2* (Rockstar Games, 2018), the aesthetic beauty of the game provided a valuable source of inspiration for her creative writing. In the expression of creativity around the game, players can explore and personalize their gaming experience through the construction of creative artefacts such as art, stories and modifications. In this way, players are consciously engaged in the construction of creative artefacts which support their personal exploration and expression of the game. While the aesthetics of the game did not afford creative actions *per se*, they contributed to the creative inspiration used in other areas of life.

In terms of *sound*, one participant referred to the synergy of musical scores, the game environment and player actions as facilitating flow (Csikszentmihalyi, 1990) and providing a sense of creation. When various different elements of the game were in sync and under the control of the player participants noted it contributed to the feeling of being creative within the game. The link between flow and creativity has been previously documented, with it being suggested that flow acts as a precursor to creative behaviour (e.g. Cseh et al., 2015; Csikszentmilhalyi, 1996). In relation to the GameFlow Model (Sweetser & Wyeth, 2005) which details the core design elements which promote flow, this highlights the role of “concentration” in the gaming experience. Concentration is maintained when the game provides stimulus from many different sources such as environment, sound and actions.

Finally, in *AI* reality-like game figure behaviour was mentioned as a facilitator for creative behaviour. This usually involved approaching gameplay more strategically due to enemy behaviour being unpredictable. This is in line with previous literature which has suggested good game design encourages risk taking and learning from failure (Gee, 2005), which are both cited to be key components of creative behaviour (Sawyer, 2006; Seddon, 2005; Seddon & Biasutti, 2009).

### 6.2.6 Content Creation

The main theme of *Content Creation* encompassed affordances related to the creation and implementation of in-game objects and media and was referenced mainly in relation to sandbox and MMORPG games where there were content creation activities. See table 29 for descriptors.

| Creation Sub-themes | Descriptor |
|---|---|
| Objects, Levels & Maps | Freedom to build in game-structures, levels, maps and variety of decorative objects to use. Options to import own images and textures and specific "creative" modes. |
| Interface | Functionality for players to capture and/or edit their own image and video footage. |
| Mods | Flexibility to add modifications which offer additional challenges and functionality. |

*Table 29: Creation Sub-Theme Descriptors*

#### 6.2.6.1 Findings

Within *objects, levels & maps,* three participants mentioned the ease of building in-game structures such as houses as facilitators for creativity. In his screenshot of *Fallout 76* (Bethesda Game Studios, 2018), one participant talks about the building he has created:

> *"So a…creative aspect I would bring up is that my top right picture is that the building itself, I made a platform myself. Because I spend a good 10 minutes to build a foundation that would align perfectly with the building. When I make a ladder and go up to that, on top of the roof of the building. And I built sentry around it, and I try and go to sleep in the middle of the day. I have a small shack going, everything here is built from the ground up. A lot of my friends say it's blended in so well, and I very love it when they compliment me like that."* – Male, 22

Other examples of games that allowed players freedom to create and design were *Minecraft* (Mojang, 2011), *Little Big Planet* (Media Molecule, 2008) and *Animal Crossing* (Nintendo, 2001). Other games such as *Fallout 76* (Bethesda Game Studios, 2018) and *Final Fantasy XIV* (Square Enix, 2010) allowed the creation of buildings, usually acting as the playable character's main base or home, however, the gameplay experience was not defined by player created content.

While "having that sandbox environment to create the levels is probably where your creativity is endless" (male, 38), one participant mentioned that "when you know you can do anything you don't really do anything at all" (non-binary, 35), suggesting a paradox between being offered limitless freedom to create and having too much freedom, which can result in the player not having any direction for their creative efforts. The same participant suggested that "you need a constraint of some kind to do something" (non-binary, 35), which may act as a scaffold for

players' creativity.

Additionally, creativity in this theme required that objects within the game needed to be useful in some way. As described by one participant in relation to *Stardew Valley* (ConcernedApe, 2016):

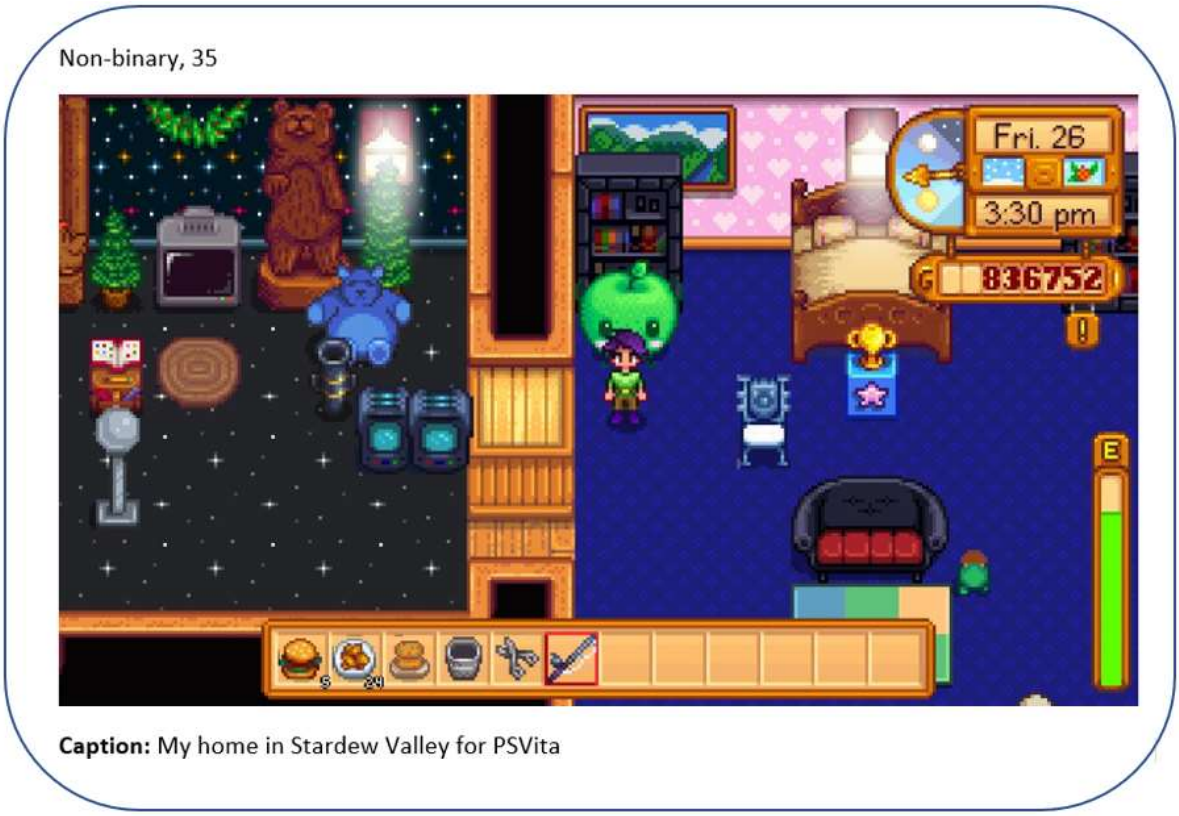



*Figure 29: Content Creation Screenshot 1*

> *"[In] Stardew Valley you can't really do any of that [interact with objects], which is why it makes no sense. It's like, I've got a sofa but I can't sit on it…and so it's like I tried and then just thought, well, if it doesn't really add anything and I don't really, it's not something I really enjoy then why keep doing it."* – Non-binary, 35

The fact that objects in *Stardew Valley* were not interactable was further compounded by the fact that it was a single player game, and the participant could not show their creations to other players or friends as "no-one's going to see it" (non-binary, 35). The player contrasted this with *Animal Crossing* (Nintendo, 2001), in which there was "stuff you can interact with, or you can sit on a chair or lie down on a bed" (non-binary, 35). By providing a more realistic experience (i.e. objects had use value as they would in real life), the player is able to design houses with the use value of objects in mind.

Being able to customise items and maps was another aspect that was cited as a facilitator, with games which allowed players to customise standard items and import their own images and textures to customise items being viewed as enabling creativity. Referring to *Little Big Planet*

(Media Molecule, 2008), one participant cited that:

> *"So in LittleBigPlanet you can actually scan your own creations in, or you've done them on the computer with Photoshop or whatever and those can be part of your level then…The interactivity of the play with the objects is highly configurable. And other than being limited by the game you are actually more limited by your imagination rather than anything that the constraints of the development."* – Male, 38

By allowing players to make items and levels more personal by importing their own creations their creativity can flow between the game and other computer applications such as Photoshop. In this way, players can experiment with elements of game design (from conception, to creation, to implementation).

One participant in his screenshot of *Final Fantasy XIV* discussed restrictions on customising items: "you get a lot of freedom in Final Fantasy XIV, but it's more restricted…its more controlled. They want you to build on the brand basically, and use standard items" (male, 30). He talks about the housing system where players can create their own "home" on a plot of land within the game world. While there is a selection of standard items to use, items cannot be customised, and placement of items can be restrictive (e.g. in instances where the player was prevented from resizing objects). To get around this, glitches are sometimes used, although patches can be released to prevent this, forcing players to "build the standard way" (male, 30).

However, as the same participant also notes, the developers do try to encourage the creativity of players by hosting contests for house building and design contests for items. In this way, while *Final Fantasy XIV* does not have the same freedom for creation that sandbox games such as *Little Big Planet* afford players, the developers attempt to combat this by explicitly encouraging players creativity through community events.

Within *interface,* two participants discussed game modes that allowed them to take and/or edit screenshots as facilitators of creativity. One example was *Fallout 76*'s (Bethesda Game Studios, 2018) "Photomode" (male, 22) and the other *Final Fantasy XV's* (Square Enix, 2018) "Camera Mode" (female, 31). Even in games which did not possess an explicit photography interface, consoles such as the Playstation 4 and the digital game distribution platform, Steam, have built in functions for players to take screenshots. As one participant noted:

> *"I do scenes where I actually set the camera access to make a more creative composition. You're a little bit more creative in the way it looks…You can [also] record video footage, and you can download that video footage, and then you can edit it and do some pretty cool things to it."* – Female, 31

By providing players with the facility to capture instances of their gaming experience (both via images and video), they can experiment with aspects of creative expression such as graphical composition. This can also lead to creation of a personal narrative where the player is able to use

the images they captured to portray their own gaming story (as previously discussed in *narrative: personal narrative*).

Finally, in *mods*, games that allowed players to implement mods also helped to facilitate creativity. In reference to *Stardew Valley* (ConcernedApe, 2016) and *Minecraft* (Mojang, 2011), one participant stated that he "preferred playing it with mods than I do without, just because there are more options" (male, 28). While mods and add-ons may provide a more customisable gaming experience, it was also noted that most games to some degree, if they are on the PC, can be modded: "If they're on the PC then they can be modded for better or worse to be honest" (male, 28), however, the same is not always true for console games where it is harder to access and modify game files.

#### 6.2.6.2 Discussion

The most commonly referenced sub-theme of creation was *objects, levels & maps,* which related to opportunities to build in-game structures, decorative objects, and create levels and maps. While sandbox style games that participants mentioned such as *Minecraft* (Mojang, 2011) and *Little Big Planet* (Media Molecule, 2008) offered distinct "modes" of play purely orientated to creation activities (e.g. creation mode), games such as *Fallout 76* (Bethesda Game Studios, 2018) and *Final Fantasy XIV* (Square Enix, 2010) still allowed players to play, create and share all within the larger game-world. Kim and Shute's (2015) two-dimensional model for creativity in games (discussed in section 2.4.3) can be reflected in the example provided by one participant relating to the building he created in *Fallout 76* (Bethesda Game Studios, 2018). Through creating a small base for himself, the participant was engaged in three levels of play: firstly, he was engaged at the "play" level as the base was created for its strategic advantage over intruders, secondly, he was engaged at the "create" level as he was actively engaged in the construction of in-game structures, and finally, he was engaged at the "share" level as his friends were able to view and use his base. Through building the base, and using it strategically against intruders, the participant was engaged in Little C creativity within the Little C domain.

The creation of *objects, levels & maps* could also be linked to the concept of interactivity in digital games. According to Weber et al. (2014) game interactivity consists of two dimensions: customisation and co-creation. Customisation relates to the creation of in-game objects, as well as altering the existing properties of objects (e.g. through sliders and customisation options). Co-creation refers to the use of level and map editors, or other tools which allow players to develop new material. However, as Behr et al. (2016) point out, customisation and co-creation may be more of a continuum, with altering in-game options on the low end to creating entirely new modifications on the high end. Such a continuum may be used to explain the opportunities for the creation of *objects, levels & maps* within games of differing structures. In the example of *Fallout 76* (Bethesda Game Studios, 2018), the game structure was not entirely sandbox. In Burri's (2011)

categories of UCC (outlined in section 2.1.2.2), games such as *Fallout 76* lie in the second category and have the possibility for UCC; with players able to create either on top of or parallel to developer's content. Games in this category allow players to customise content or add packaged content and as such may lie on the low to mid end of the customisation/co-creation continuum.

However, in the example provided by one participant relating to *Little Big Planet* (Media Molecule, 2008), he could not only customise objects, levels and maps, but also import his own content into the game, allowing complete freedom to create almost anything. Similarly, in *mods* one participant mentioned he "preferred" playing with modifications and cited both *Minecraft* (Mojang, 2011) and *Stardew Valley* (ConcernedApe, 2016) as allowing the implementation of player developed mods. Games such as this afford creativity at the high end of the customisation/co-creation continuum and lie in Burri's (2011) third category of UCC where the game is defined by the creations of players.

While different game structures afford different levels of customisation/co-creation, it was noted by one participant that there is a possibility of actually being demotivated by having limitless freedom: a plethora of choice can lead to inactivity or standing still. This tension may point to differences in player motivations: some players may prefer games which lie in the second category of UCC offering more structured creation options (e.g. customising packaged content), which may help scaffold their creativity. However, this may be seen as too constraining for others who wish to create their own, entirely new content and may prefer games which fall in the third category of UCC.

One aspect mentioned, predominantly in relation to games within the second category of UCC, was the relationship between the object being created or customised and its primary function within the game world. As noted by two participants, objects which did not allow their primary function to be realised (e.g. a sofa you cannot sit on), were inhibitors for creativity as it was seen there was no point in them being there. As such, in reference to Cardona-Rivera and Young's (2013) cognitive theory of affordances, the design of placeable objects in creation mode needs to accommodate the real affordances associated with those objects, otherwise there is a mismatch between the perceived affordance of the player (e.g. to sit on the sofa) and the real affordance of the object (e.g. a sofa which does not allow the player to interact).

Finally, *interface* options were also mentioned as contributing to player creativity, predominantly in relation to games that came packaged with an image/video capture and editor feature, as well as in-built features within consoles such as the Playstation 4 and game distribution platforms such as Steam. As one participant explained, such options allowed her to set up shots for a more "creative composition" (female, 31), or similarly to capture scenes to be

used as inspiration for creative writing, as another participant noted in *personal narrative*. Interface options such as this allow players to not only engage with the game on a gameplay level, but also provide opportunities to realise their own creative ideas. In this way, the game provides players with the creative medium (e.g. in terms of graphics, characters, objects), and *interface* options allow players to manipulate the medium as they see fit. Such interactions with *interface* options pose the question as to what extent game interactivity covers creativity outside of the default customisation/co-creation options. While Behr et al. (2016) point to creativity in terms of customisation and co-creation activities which are directly related to gameplay (e.g. customising stats, armour, creating levels, etc), the use of *interface* options to realise creative ideas by using the game as a creative medium in a more traditional sense (e.g. focusing on composition and placement) does not directly affect gameplay elements. In this way, interface affordances may contribute more towards the transferability of creative ideas than being creative within games.

### 6.2.7 Avatar

The main theme of *Avatar* included aspects related to character/avatar appearance such as character creation choices and outfit selections. It was divided into the subthemes of *appearance* and *emotes & voice*. See table 30 for descriptors.

| **Avatar**<br>**Sub-themes** | **Descriptor** |
|---|---|
| Appearance | Includes options for customisation of playable character/avatar such as gender/hair/body options, as well as selection of outfits. Options for players to import their own textures to use in outfits. |
| Emotes & Voice | Includes options for the customisation of emotes and choice of different character voices. |

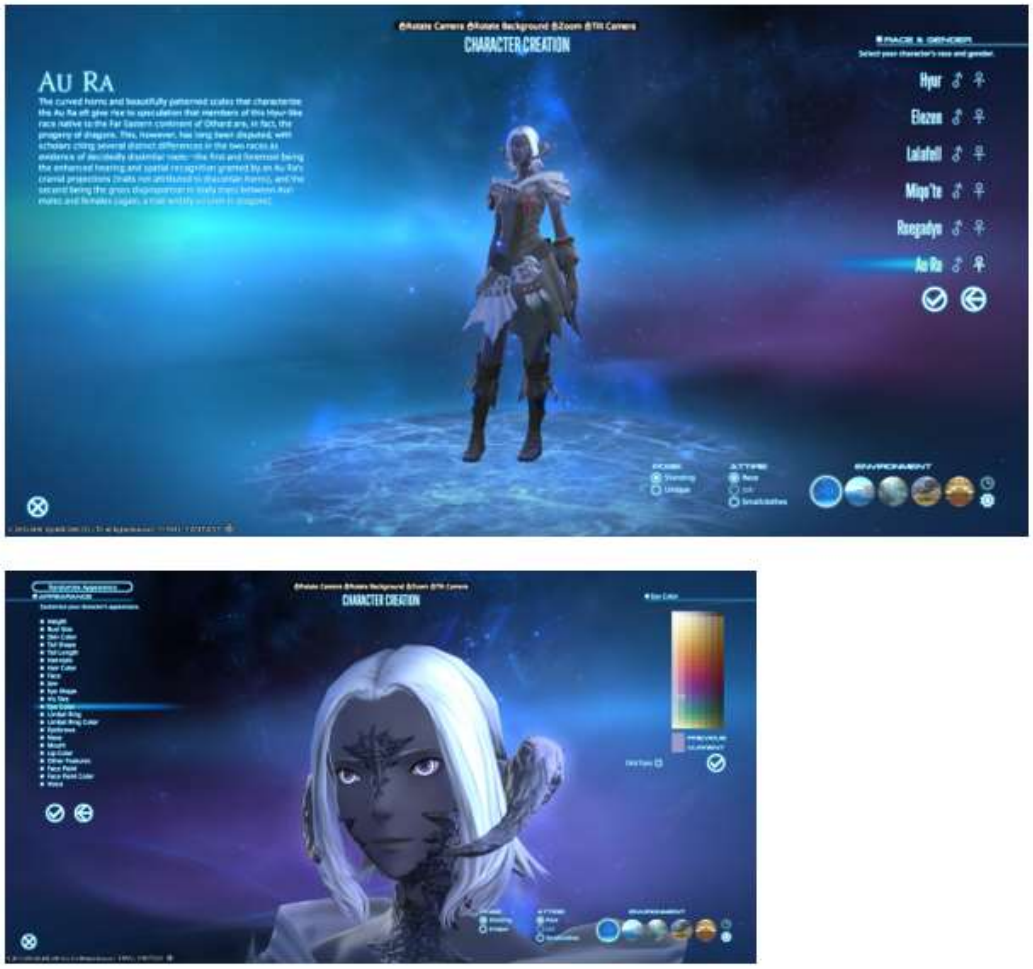
*Table 30: Avatar sub-theme descriptors*

#### 6.2.7.1 Findings

In *appearance*, four participants said that customisable options for character appearance facilitated their creativity. In reference to *Fallout: New Vegas* (Obsidian, 2010), one participant referenced the character creation screen at the start of the game where "you can portray your character in really different ways, and sometimes really weird ways" (male, 28). Furthermore, as another participant noted in his screenshot of *Fallout 76* (Bethesda Game Studios, 2018), the option was available to change how his character looked at "any moment of the game", allowing him to "add more scars and damage to my character to signify the time I went through" (male, 22). This feature enabled him to evolve his character in accordance with his own personal narrative.

Another participant referenced *Final Fantasy XIV* (Square Enix, 2010) where, due to its online element, players often wanted to stand out by creating interesting avatars. Customisation was enhanced by a multitude of options – with each leading to further options and "sliders" (e.g. small to large gradient adjustments) for more detail. Furthermore, the game also provides the ability to view the player's avatar in various environments, each with differing levels of light. This is illustrated in his screenshot of the character creation screen:

Male, 30




**Caption:** Character creation

**Any additional comments:** There are a lot of options in character creation, but they're not infinite. You can't change body shape (other than bust size on female model characters.....) There are no old or ugly faces for female characters (men of a couple of the races do have such options.)

*Figure 30: Avatar Screenshot 1*

*"So you're going to choose what this character's going to be, and who you are, and that's how you're going to be represented in this crowd of many people, because it's an instant MMO. So it's sort of like here's an opportunity where you're expressly encouraged to be creative. But there's certain rules in place."*
– Male, 35

While the level of detail which can be customised acts as a facilitator for creativity, the participant points out “there are certain rules in place”, which mean some aspects are limited such as body shape and age. For example, there are only a limited number of face shapes which can be used.

*Onrush* (Codemasters, 2018) was also mentioned in relation to its customisation ability by one participant. However, while games such as *Final Fantasy XIV* (Square Enix, 2010) provide the player with all customisation options in the initial character creation screen, *Onrush* unlocks new options as the game progresses.

Male, 38


**Caption:** Changing outfits in OnRush

**Any additional comments:** The gear item’s styles are in keeping with the game’s cool, trendy, X-Games style. It’s great to personalise your character but you are restricted by what you unlock and eventually when playing online you do see quite a few people with the same outfits. But there is still plenty of variety – though you are restricted to what is in the game, no option to upload your own designs.

*Figure 31: Avatar Screenshot 2*

The participant notes that while there are a lot of ways to personalise his avatar, when playing the game online, it is very difficult to stand out as eventually everyone has the same outfits, suggesting that online games may need a greater number of customisable options for players to feel their avatars are unique. Thus, the lack of options for players to import their own designs may inhibit creativity. This was contrasted to *Little Big Planet* (Media Molecule, 2008) where there is

the option to import designs, images and textures for use in level, object and costume design, allowing for further opportunities to be creative.

Finally, in *emotes & voice*, one participant in his screenshot of *Onrush* (Codemasters, 2018), noted that the game allows players to preconfigure various emotes of how their characters will react in certain situations such as winning and losing. This facilitated creativity as "you can personalise it to quite a degree" (male, 38) and, thus, not only customise the appearance but also actions of the playable character. In contrast, in his screenshot of *Final Fantasy XIV* (Square Enix, 2010) another participant spoke about the lack of customisable "grunts" (each race has only a select number of voices): "the biggest criticism everyone has of character creation is you can't create your combat grunts" (male, 30). As the player may be spending numerous hours playing with one character, being stuck with a "really annoying sound in combat" (male, 30) adds a level of frustration to the gaming experience. While developers may wish to standardise such elements, especially in large AAA (i.e. high budget) titles, the lack of ability for players to create a representation of their ideal avatar may prove to be an inhibitor for creativity.

#### 6.2.7.2 Discussion

In *appearance*, participants mentioned that games which allowed them to fully customise their avatar's appearance contributed to their creativity. This is in line with previous work that has argued affordances for character design such as "individual combinations of attributes, adornments, skills and traits" (Dickey, 2007, p. 257) are an element that contributes to intrinsically motivating gameplay experiences, as well as increased feelings of presence (Bailey et al., 2009). Similarly, Weber et al. (2014) found that players rated interactivity higher on games that offered more customisation options for avatar appearance, abilities, accessories, equipment and performance. Behr et al. (2016) argue "players not only enjoy the opportunity to customize their character, but also that players use customization features to creatively tune their character based on momentary game demands" (Behr et al., 2016, p. 291).

The opportunity to customize avatar *appearance* at any given time was highlighted by one participant in relation to *Fallout 76* (Bethesda Game Studios, 2018), which allowed him to alter his character's appearance at "any moment of the game" (male, 22). This functionality provided support for the creation of his own *personal narrative* – as he progressed through the game, he could add features such as scars to his character to mark his journey through the game world. Opportunities to customise avatar appearance throughout the game (as opposed to solely at the start) allow the game to be momentarily adjusted to "suit individual needs [and] allow players to creatively alter the video game experience" (Behr et al., 2016, p. 292).

Some games allow players to view their avatar in the character creation screen in different situations and lighting. One participant referenced *Final Fantasy XIV* (Square Enix, 2010)

which afforded options for different backgrounds, in addition to cascading sliders. It was also noted, however, while there were a multitude of different appearance options, they tended to err on the side of stereotypes, not providing options for alternative appearances or non-binary genders. It has been suggested that games which allow players to create their own avatars support identity experimentation and provide a means for players to view things from a different perspective (Lee & Hoadley, 2007; Oliver & Carr, 2009; Ward, 2015). However, several studies have also suggested that players prefer to play avatars that are similar to themselves (Hsu et al., 2007, 2005; Ogletree & Drake, 2007; Trepte et al., 2011), and often strive for identification with their avatars in terms of gender (Behr et al., 2016). As Dickey (2007) further points out, affordances for character development play a crucial role in fostering intrinsic motivation, and often players feel emotional proximity to their avatar, which they have spent so long creating. As such, by only offering customisation options that align with certain "stereotypes" (e.g. youthful, muscular males), not all players may be catered for in terms of their ideal avatar appearance. Such option could hinder the emotional proximity players feel towards their avatar and the creativity involved in constructing their own *personal narrative*.

In *voice & emotes* participants also spoke about avatar customisation options. As one participant noted in *Onrush* (Codemasters, 2018), the game allows players to preconfigure various emotes, affording a greater degree of personalisation. Voulgari et al.'s (2014) framework for the exploration of learning outcomes and processes in MMOGs highlights the role of interaction affordances such as emotes. *Emotes* constitute both a way in which players can be creative and further personalise their avatar and provide a means of non-verbal communication in online games. In contrast, as was noted by another participant in relation to the customisation of "grunts" (e.g. voices for different avatar races) in *Final Fantasy XIV* (Square Enix, 2010), the game did not cater for a variety of different voices meaning that even if a player preferred playing a certain race (e.g. due to appearance options, skills or lore) they may be stuck with a voice they dislike. As above, in *appearance*, by not providing a larger variety of voices, players may not be able to create their ideal avatar. Going back to Burri's (2011) three levels of UCC, games which lie in the third category and allow players to import their own content such as sounds, images and textures could aid in the potential for player creativity by providing opportunities for players to customise not just the appearance, but also voices of their avatars.

### 6.2.8 Progression

The theme of *Progression* encapsulated instances relating to participant's progression, or sense of progression within a game, including achievements and unlockable items. See table 31 for descriptors.

| **Progression** | |
|---|---|
| **Sub-theme** | **Descriptor** |
| Challenges | Progression of challenges (or sense of) such as levels getting harder incrementally along with player skill and optional challenges or achievements. |
| Paid Features & Unlockables | Instances related to the use of paid features which contribute to or restrict progression (or sense of). Additionally, instances related to aspects of the game which are unlocked as the player progresses. |

*Table 31*: *Progression Sub-Theme Descriptors*

#### 6.2.8.1 Findings

The most commonly referenced aspect of progression was games where *challenges* increased synonymously with players' skills. Participants mentioned that they felt games that utilised this design feature as being conducive to their creativity. For example, in *Oxygen Not Included* (Klei Entertainment, 2017) one participant described how the game allowed him to get to grips with the mechanics by building simple things before moving on to more complicated constructions:

Male, 22

**Caption:** (This is a picture of an old save of mine)

Orange: Cold Biom being constructed as a new Power Station (Cold is needed to combat heat output of Coal Generator)

Purple: Current Power Station, isolated but the heat will slowly spread throughout the colony

Magenta: Sleeping rooms of Dupes and Dining room (Dupes stand for Duplicates/ The individual are copies that are sent through the Printing Pod

Green: Farming station...

Blue: Water Plants and Water purifying system. The green liquid is contaminated water and blue is clean that will be used.

Brown: Latrines

**Additional Comment:** The game Oxygen not Included is a colony building game that has very complex systems of plumping, electricity, pressure and colony management.... this is one very creative game I truly believe that I would take a long time for me to know, understand and master all of its creative elements.

*Figure 32: Progression Screenshot 1*

*"So this is one of my colonies at least 86 days in, and I start in the centre….I start with that. So it's outside the purple, it's in the middle of the pink, and a little bit left of the green on the right. That little part is what I started with, and I only have that. And then I start building more and more complicated stuff."* – Male, 22

Additionally, one participant in his screenshot of *Thomas Was Alone* (Bithell Games, 2012) pointed out the timing of hints: "one of them [shapes] floats in water and it tells you because I don't think you would put it in water because the other blocks drown…But they don't tell you any of the combinations [of shapes]" (male, 35). By providing hints relating to things that the player would most likely not attempt, the game helps scaffold creativity by providing just enough information to the player and allowing them to experiment with the different combinations of shapes and their abilities. Thus, by providing hints at appropriate times (e.g. with the introduction of new shapes), the progression of the player through the game is guided in such a way which encourages exploration and discovery.

Finally, in relation to the increase of challenge, one participant cited that she enjoyed games that have achievements in them (optional challenges) as they provided her additional challenges which she could engage in as her skills in the game progressed. Furthermore, she also cited that being able to complete these achievements in multiple ways helped facilitate her creativity and allowed her to complete each challenge differently in each playthrough (discussed previously in *Degree of Flexibility: task flexibility*).

In *paid features & unlockables,* participants referenced instances where games had deployed paid features such as loot boxes (boxes containing in-game items) or "pay to win". Referencing *Onrush* (Codemasters, 2018) one participant stated you could purchase loot boxes using real world money, however, such purchases did not affect the overall ability of players. Instead loot boxes would unlock aesthetic objects such as "new characters, outfits and whatever" (male, 38) and helped provide a reward for those who had played a significant amount of time. While loot boxes were not related to progression per se, they were an outcome of progression in the game and helped distinguish between veterans and newcomers in online play.

On the other hand, while loot boxes may not contribute to player ability, "pay to win" features were cited as being an obstacle to player ability. One participant referenced *Pokemon Shuffle* (Genius Sonority, 2015) where the format is similar to a mobile game where you purchase in-game currency using real world money. They had spent a significant amount of time playing the game and then "hit a brick wall" (non-binary, 35) where the only way to progress was to purchase items using real money.

> *"I really wanted to solve this problem, I really want to work through this puzzle, but actually I've been stopped by business requirements and it really takes you out of the game and you just start thinking about the meta of the whole, oh, this is just because Nintendo want me to spend money on this rather than me just being able to play it and I think that's quite frustrating, because I've been playing it for quite a while, so I'm quite far into it as well."* – Non-binary, 35

Other games cited that required a "pay to win" approach included the online card game *Hearthstone* (Blizzard Entertainment, 2014). Additionally, *World of Warcraft* (Blizzard Entertainment, 2004) was cited as being particularly difficult to get into as a new player as "the entire game is balanced around people who've been playing it for 10 years" (non-binary, 35). While *World of Warcraft* did not require players to purchase ability enhancing items using real-world money, a player is required to have several other high levelled characters capable of making enough in-game money to acquire them for their lower levelled characters.

#### 6.2.8.2 Discussion

In *challenges,* participants noted instances of game difficulty and in relation to the notion of flow (Csikszentmihalyi, 1990), whereby challenges increase incrementally in line with skill level. Going back to Sweetser and Wyeth's (2005) GameFlow model, challenge plays an important role in the gaming experience where it is important to introduce challenge at an appropriate pace and scale with skill as the players develop their abilities. Similarly, in addition to progression within the main game, optional achievements provide another way for player skills to be tested. Furthermore, as pointed out by another participant in relation to *Thomas Was Alone* (Bithell Games, 2012), games can provide hints as to how to use new abilities or shapes. Providing hints at appropriate times is reflected in the player skill element of the GameFlow model, which states that game should be intuitive, with initial tutorials or hints when new things are introduced. Such scaffolding not only helps maintain a flow state, but also scaffolds player creativity by providing just enough information to the player to allow them to experiment with different combinations of items and abilities.

In *paid features & unlockables* participants referred to how the progress of the game was related to what items, outfits or characters were available. In general, paid features were seen as acceptable if they did not directly relate to gameplay – as one participant illustrated in *Onrush* (Codemasters, 2018), the purchase of loot boxes containing vanity items did not affect the overall ability of players. In contrast, a reference to *Pokemon Shuffle* (Genius Sonority, 2015) highlighted how paid features could detract from the gaming experience if they acted as an obstacle to a player's ability and creativity. In this way, player skill no longer dictates game progression, which instead becomes only feasible with the purchase of items. Going back to the element of control in the GameFlow model (Sweetser & Wyeth, 2005), by providing a barrier to player skills, "pay to win" games prevent players from feeling control over their actions and having freedom to creatively experiment with different solutions.

### 6.2.9 Replayability

*Replayability* related to instances where participants spoke about the replay value of a game, such as what updates and patches developers released to renew the gaming experience. *Replayability* was the least referenced category and no participants captured screenshots of instances relating to the theme. See table 32 for descriptors.

| **Replayability Sub-themes** | **Descriptor** |
|---|---|
| Updates | Renewal of the gaming experience through updates, downloadable content and patches. |
| Developer Events | Developer run community events such as competitions. |

*Table 32: Replayability sub-theme descriptors*

#### 6.2.9.1 Findings

The main topic in *updates* related to how modern games are often updated or altered with new content by developers. One participant who captured *Final Fantasy XV* (Square Enix, 2018) in her screenshot, commented on how the original game was expanded upon when the developers released DLCs (downloadable contents), which implemented new adventures focusing on the main characters in the game. In *Final Fantasy XV* the player controls the main character, Noctis, who has three companions throughout the game: Prompto, Ignis and Gladiolus. The developers released DLCs with background stories for each of Noctis' companions:

> *"And with the DLC, I think that's also something that's turning into more creative stuff, is that the DLC components of these newer games where you have the main game, and then of course the publishers to make more money they're bringing in all this extra content. So Prompto has his own story, which was like a first-person shooter. Ignis has his own thing, and Gladiolus had his own thing. And then that gives you more content and video footage to do whatever you want with it."* (female, 31).

Through providing additional story content, player creativity may be facilitated in terms of the incorporation of these narrative elements into their own creative pursuits inspired by the game.

In the case of the offline game *Final Fantasy XV* (Square Enix, 2018) developers released new content in addition to the main game (i.e. each adventure could be played as a stand-alone game in itself). As another participant mentioned in relation to the MMORPG *Final Fantasy XIV* (Square Enix, 2010), developers are listening more to what players want and are trying to release updates and expansions to address player concerns. An example was given in relation to the "imbalance problem" when an online game has several crowded servers, and others are sparsely populated. On crowded servers, players are no longer able to create new characters, or to join their friends. To address this, developers are "actually going to solve this problem in the next expansion pack by letting you travel between worlds on the same sort of server cluster" (male,

30). By allowing players to travel between servers, they have more scope for interacting with others and building houses on different servers.

Finally, in relation to online games, *developer events* such as competitions for players helped refresh the gaming experience by providing additional challenges and activities in relation to the main game, hence promoting player creativity. For example, one participant who captured *Ring of Elysium* (Tencent Games, 2018) provided an example:

> *"I think the Ring of Elysium have their own Twitter…and they're running challenges like let's find something on this map. Like always they are putting something, some hidden gems there…and they are asking the community just find something in the map [that] we hid in there. We are not going to give you clues what is it; just go there and have adventure and make a picture from the game and show it on the Twitter. I know they are looking to get more people to spend more time on the game but it's still fun to find some hidden stuff there."* – Male, 32

Players are encouraged to take pictures of their finds and post these to the official Twitter page for other members of the community to see. This provides an additional challenge for those who wish to take part in it, and provides images detailing the strange and bizarre hidden objects in the game for those who do not. Similar views were also cited by the participant who captured *Final Fantasy XIV* (Square Enix, 2010) who explained that developers ran various contests for players to take part in such as for designing objects and showcasing their artwork and images of their in-game houses (as mentioned in *Content Creation*). These events not only provide additional motivation for playing the game, but also facilitate creativity by allowing the gaming community to play a part in the development of the game.

#### 6.2.9.2 Discussion

The theme of *replayability* related to ways in which the gaming experience was renewed through *updates* and *developer events*. While such aspects may not be considered affordances in the traditional sense, they provided opportunities for players to be creative and engage in the game development community.

*Updates* was the most referenced sub-theme and related to how many games are now updated and expanded upon with patches and DLCs. This was the case for both online games and offline, single player games. According to Rifkin (2005), instead of creating games as fixed items, game companies are now producing platforms open to upgrades and the implementation of new services. For instance, one participant mentioned *Final Fantasy XV* (Square Enix, 2018), offers DLCs that expand upon the story of the main game thus providing further gaming content to incorporate into other creative pursuits. While this may not be the case for all players, it suggests that expanding on the game not only provides additional gameplay, but also provides inspiration

for creativity around the game. By replaying the game, the player may become more involved in the narrative and hence, replayability provides more capacity for players to be creative.

While DLCs in offline single player games can offer stand-alone content, it is customary in online games such as *Final Fantasy XIV* (Square Enix, 2010) for new content to be directly added into the game. According to Herodotou et al. (2014), the flexible design of online games allows the implementation of updates and expansions which "renew the game experience, attract gamers' interest, and raise game participation" (Herodotou et al., 2014, p. 259). In addition, the example provided by one participant regarding *Final Fantasy XIV* (Square Enix, 2010) illustrated how developers are now listening more to players and attempting to address various balance issues reported to them. This suggests that developers may be viewing the role of players more in the light of the game creation process.

Finally, in *developer events*, the co-creation process between developers and players was highlighted by the various competitions and events hosted by developers. Some examples included house building contents in *Final Fantasy XIV* (Square Enix, 2010) and Easter Egg hunts in *Ring of Elysium* (Tencent Games, 2018). As Sotamaa (2010) points out, designing games as updatable and flexible platforms allows developers to host professionally created branded content and content created by players. In this way, the player is involved in a dual role as a skilful creator, and member of the game audience.

## 6.3 Conclusion

Phase 3 comprised of a reflexive photography task combined with photo-elicitation interviews with 9 participants. The aim of the study was to answer research question *RQ3: What specific game design affordances contribute to player creativity?* In total eight main design affordances were identified which contributed to player creativity. They can be aligned with different types of creative expression as developed in Chapter 4 (see figure 33).

Affordances for *degree of flexibility* related predominantly to the overall game structure (i.e. open versus linear). *Degree of flexibility* afforded opportunities to direct the route of play and accommodate divergent solutions to gaming challenges. As such, this theme was most aligned with the expression of *creativity as problem-solving* and *creativity as appropriation*. In the former, players can create personally unique strategies to accomplish tasks, and in the latter, the flexibility of the route of play allows for the creation of new challenges and emergent play.

Affordances for *narrative* related to the narrative structure of the game, and how such structure influences creativity. This was achieved through engaging storytelling, the creation of

personal narratives and narrative exploration. *Narrative* was most aligned with *creativity as affective change* as it often involved participant's reflections on the game narrative, as well as affective outcomes associated with emotional challenges.

Affordances for *tools* related to the different game variables offered to players such as items and abilities and range of movement. *Tools* most aligned with *creativity as problem-solving* in terms of strategic use of items, abilities and movements, and with *creativity as appropriation* in terms of emergent combinations of game variables, and the use of movements to find glitches.

Affordances for *environment* related to how the various facets of the game environment provided opportunities for creative behaviour. *Environment* presents opportunities for *creativity as problem-solving* by providing environmental interaction opportunities, discoverable objects and locations and realistic AI behaviour which facilitates a more tactical approach to gameplay.

Affordances for *content creation* related to the creation and implementation of in-game objects and media such as maps, modifications and interfaces. *Content creation* was most aligned with *creativity as appropriation* in terms of allowing players to augment their gaming experience through the addition of modifications and player created artefacts. Additionally, interface options such as photomode allow players to capture their gaming experience by setting up shots and using these images on a macro level.

Affordances for *avatar* related to avatar personalisation including altering appearance and customising *voice* and *emotes*. *Avatar* supported *creativity as affective change* by allowing players to create their ideal avatar as well as experiment with different personas and facilitate the construction of their own personal narrative.

Affordances for *replayability* related to renewal of the gaming experience through patches, updates and developer events. *Replayability* presented opportunities for *creativity as appropriation* in terms of presenting new material to players which they could personalise, as well as providing a platform for players to create and share their own content in community competitions.

Lastly, *progression* was not linked to any particular creative expression, instead serving as a motivator for play through providing optimal challenges and sustaining a flow state. While affordances for *progression* do not directly contribute to the creative expressions, they may contribute indirectly by helping maintain player motivation.

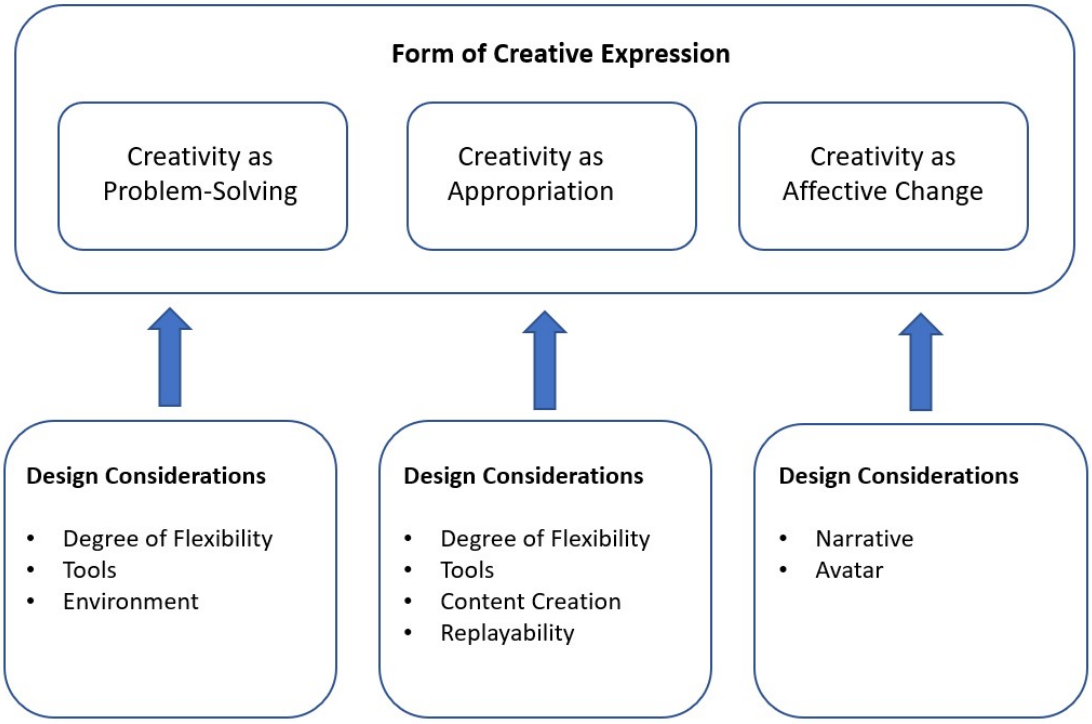



*Figure 33: Design Affordances and Creative Expressions*

## 6.4 Limitations and Recommendations

The reflexive photographic method has not been used previously to the author's knowledge within this subject area, and hence, this study has been a learning process in the use of reflexive photography to study player experience. As such several limitations were identified alongside recommendations for future studies hoping to utilise reflexive photography to study player experience.

The first limitation related to the timeframe in which participants took their screenshots. Traditional reflexive photography studies have delineated a certain amount of time for participants to capture their experiences (usually a week or two). In the context of this study, which involved creativity, it became apparent that participants felt they were somewhat restricted by the timescale. For example, several participants noted that there had been previous creative moments before their "screenshot week" but they had not taken screenshots during these instances as it was outside their designated week. Additionally, one participant commented that having a designated week to take screenshots had made her more aware of her creative actions within games. While this may not necessarily have been a negative, it does give rise to the question of whether the reflexive photographic method may have impacted on what participants view as creative in games. One participant who was already practised in taking screenshots of creative moments as part of her gaming experiences asked if she could use some of the images from her portfolio. Using participants who already engage in taking screenshots may alleviate the

issue of having a designated “screenshot week”, however, it then runs the risk of only attracting participants who already engage in creative gaming pursuits. As such, future studies may wish to focus on those who already engage in screenshot activity and gather pre-existing screenshots, or to designate a longer period of time for participants to take screenshots such as a one-month period. As creativity is largely subjective and unpredictable (e.g. you don’t plan ahead for it), a longer period of time to take screenshots would allow participants more opportunity so they are not waiting for one “screenshot week”.

Another issue related to the time spent taking screenshots each day. Initially, when the information sheet on the study was sent out to participants, two participants displayed hesitations as they interpreted it as having to play games every single day for a week. As such the information leaflet was adapted accordingly to specify that taking screenshots was to coincide with participants’ normal gaming habits and did not require them to play more or less than they already did. This did not necessarily involve taking screenshots every single day for the course of a week, only during the normal times in which participants would play. In previous studies on reflexive photography it is not made clear if participants are taking photographs every day of the week or just during their regular activities, and as such is something that would be valuable to consider in future studies using this method.

When asked to give feedback regarding the reflexive photography methodology, several participants mentioned the potential use of video footage, saying that it may be beneficial to use alongside the screenshot method. By capturing video throughout a session, participants would not have to consciously think about taking screenshots, which was highlighted by one participant who spoke about a creative moment in which she was so involved in she ended up taking the screenshot after the moment had passed. While images still provided a memory aid in which to discuss the creative moment, video footage would enable the whole creative act to be captured. However, a significant amount of time would be needed to analyse such footage as this would run into the tens of hours (or hundreds depending on the number of participants). Such future work using video capture alongside screenshots may be more suited to a scenario where there are multiple researchers analysing the data.

Finally, while this study provided an in-depth view of the different design affordances, it only captured the experiences of 9 participants and as such findings are not generalisable. A range of different game genres were used in the study to attempt to provide a holistic overview of the design affordances for creativity in digital entertainment games in general. Future reflexive photography studies could endeavour to obtain a greater sample size in addition to narrowing down the design affordances in relation to particular game genres.

## 6.5 Summary and Implications

Phase 3 used a hybrid thematic approach to refine the *design affordance* themes from phase 1 into higher-level sub-themes, and inductively identify any new design affordances. In total six design affordances were identified which supported player creativity: *degree of flexibility, narrative, tools, content creation, environment* and *replayability*. The design affordance of *progression* supported player motivation which may act as a mediator for creativity.

The contribution of phase 3 was to provide a link between aspects of game design and creative expressions. While previous work has considered how game design can be tailored towards promoting motivation and flow (e.g. Sweetser & Wyeth, 2005), there is significantly less literature which seeks to identify how design elements may facilitate creativity. As such, the findings of phase 3 provide implications for developers, both of entertainment and educational games, in relation to designing games to specifically foster creativity. Furthermore, there are implications for researchers in the fields of game studies and human-computer interaction by providing an initial framework which could be used to analyse games for their creative potential. By understanding which design affordances, in which game genres, contribute to specific creative expressions, educators could select games accordingly to develop creativity in students.

# 7. Conclusions

The final chapter of this thesis will outline the main conclusions and implications of the research in terms of theoretical and methodological contributions. These contributions provide implications for a variety of stakeholders including researchers and academics, educators and game designers. Section 7.1 will present an overview of the main conclusions to each of the research questions. Section 7.2 will expound the theoretical contributions associated with each of the research questions. Section 7.3 will outline the methodological contributions. Section 7.4 will posit the limitations relating to the thesis in totality and, finally, section 7.5 will present some avenues for future work in light of the project findings.

## 7.1 Overview of Main Findings

This thesis presented the work of a mixed-method project comprising of three phases which aimed to examine player creativity within digital entertainment games.

Phase 1 comprised of exploratory semi-structured interviews with 24 participants, in addition a narrative survey was completed by 14 participants. Phase 2 comprised of an online survey completed by 251 respondents. Phase 3 comprised of a reflexive photography task and photo-elicitation interviews with 9 participants. Conclusions to each of the research questions are presented below:

*RQ 1a: How is creativity expressed within digital entertainment games?*

Using pre-existing literature relating to creativity in digital games, three different expressions of player creativity were developed deductively in phase 1 and further uncovered as latent factors through principal component analysis in phase 2. In conclusion to RQ1a, creativity in digital games can be expressed through problem-solving, appropriation and affective change. A summary of the different forms of creative expression is as follows:

- Creativity as problem-solving comprised of developing personally novel solutions to problems, discoveries and ways of approaching difficult challenges.
- Creativity as appropriation comprised of the different ways players could go above and beyond what developers expected.
- Creativity as affective change comprised of the creation of personally meaningful insights, instances of reflection and altering of views and perceptions.

*RQ 1b: How do players themselves conceptualise creativity within digital entertainment games?*

Player conceptualisations of creativity were addressed in phase 1 of the project through the creation of inductive themes. In conclusion to RQ1b, players conceptualise creativity from three distinct viewpoints and usually hold more than one conceptualisation of what it means to be creative in games. A summary of the different conceptualisations is as follows:

- Players conceptualise creativity in relation to the unique ways of thinking which games encourage, such as "out of the box thinking" and a propensity to explore and test boundaries of acceptable behaviour.
- Players conceptualise creativity in relation to the construction of in-game content such as objects, maps, levels and modifications.
- Players conceptualise creativity from a development standpoint, with digital games being an artform in their own right, similar to other forms of creative media.

*RQ 2a: What do players learn from engaging in game-based creative practices?*

Learning was addressed in phase 1 through the formulation of inductive learning themes, and in phase 2 through the online survey which attempted to link specific learning outcomes to the three forms of creative expression (RQ1a). In conclusion to RQ2a, players may learn a variety of different skills, abilities and knowledge from being creative in games, however, any inferences between specific learning outcomes and creativity cannot be drawn. A summary of the learning findings is as follows:

- Phase 1 findings suggested players may learn a variety of different skills and knowledge with learning outcomes relating to cognitive competencies, game specific skills, historical and cultural knowledge, social skills, literacy skills, motor skills and musical compositional knowledge.
- On the CGS, scores on the problem-solving subscale predicted the learning outcome of reaction speed at the $p < .01$ significance level.
- On the CGS, scores on the affective change subscale predicted the development of art/craft ability and empathy at $p < .05$ and $p < .01$ significance levels respectively.

*RQ 2b: What aspects of game-based creativity are transferrable between games and other areas of life?*

Transferability was addressed through the formulation of inductive themes in phase 1 and further uncovered as a latent factor, through principal component analysis in phase 2. Phase 2 also

attempted to link the forms of creative expression and learning outcomes to transferability. In conclusion to RQ2b, the creative expression, inspiration and learning which occurs from being creative in games may transfer, multidirectionally, between games and other areas of life. A summary of the transferability findings is as follows:

- Phase 1 suggested the transfer of creativity was multidirectional between games and other areas of life.
- Phase 1 suggested ideas and inspiration transferred from games to real-life creative hobbies and vice versa.
- Phase 1 suggested various life skills such as cognitive competencies as well as affective aspects were transferrable to multiple areas of life and not tied to any specific domain.
- Phase 1 suggested skills such as organisation and planning are transferrable from games to the workplace.
- On the CGS, scores on the subscales of problem-solving and affective change predicted scores on the transferability subscale at the $p < .001$ significance level.
- On the CGS, the learning outcomes of language skills, technical skills, critical thinking and confidence predicted scores on the transferability subscale between $p < .05$ and $p < .01$ significance levels.

*RQ 3: What specific game design affordances contribute to player creativity?*

Design affordances was a theme inductively identified in phase 1 which was further refined in phase 3 through reflexive photography. In conclusion to RQ3, seven design affordances were uncovered which supported the three expressions of creativity and one which supported player motivation.

- Design affordances related to the degree of flexibility of game structures, narrative, tools, content creation, environment, avatar customisation and replayability.
- The design affordance related to progression supported player motivation which may act as an indirect facilitator for creative behaviour.
- Creativity as problem-solving is supported by design affordances for degree of flexibility, tools and environment.
- Creativity as appropriation is supported by design affordances for task flexibility, tools, content creation and replayability.
- Creativity as affective change is supported by design affordances for narrative and avatar customisation.

- On the CGS, scores on the design affordance subscale did not influence reported learning outcomes or scores on the transferability subscale. This could be due to design affordances acting as mediators for the different expressions of creativity.

## 7.2 Theoretical Contributions

This thesis presents a total of five unique contributions to knowledge that relate to providing a varied definition of creativity for digital games, understanding creativity as a key aspect of player experience, understanding creativity as a catalyst for learning, exploring the transferable nature of creativity, and considering game design for player creativity.

### 7.2.1 A Wider Definition of Creativity

As, to the author's knowledge, there exists no current definition of creativity which encompasses all different creative forms, a major contribution of this thesis is that it provides a wider definition of creativity which encompasses creative acts both large and small, and as such, examines multiple expressions of creativity in digital games. The definition presented in section 2.1.3 and used in the context of this thesis is:

> *Creativity involves the formulation of new ideas as well as novel application of old ones, the creation of artefacts and knowledge, and the stretching and altering of mental boundaries in thinking, reasoning and emotions. Hence, creativity does not encompass merely inventing, it also involves altering and integrating. It is both an outcome in itself as well as a process leading to the development of abilities and learning. It is fluid and depends as much on the individual as the context in which it takes place. Problem-solving is often at the heart of both big and small creative acts and can serve as a foundation for the discovery of new ideas, methods or viewpoints.*

This definition has emerged from both the review of current literature (e.g. Csikszentmilhalyi, 1996; Finke et al., 1992; Kaufman & Beghetto, 2009; Richards et al., 1988) and was validated through three empirical studies. As such, this definition of creativity does not limit creative acts to only one form but provides a means by which future work can identify all facets of what it means to be creative. While the creative expressions of problem-solving, appropriation and affective change were analysed and discussed from a digital-games perspective and as such, would provide a means of categorising creativity for future researchers in the field, they also provide a demarcation for the analysis of creativity in other domains such as education.

While this thesis presents an account of the different expressions of creativity in digital entertainment games, these expressions of creativity could be refined further in relation to

serious games and those with educational goals in mind. Creativity in the context of games designed for entertainment and those designed with educational goals may be significantly different – for instance in the case of educational games players would already be aware that the game aims at developing a specific learning goal. Such knowledge could impact the way in which creativity is expressed, and the propensity for players to reflect on their creative behaviour.

In addition, this thesis contributes a metric for player creativity in digital games: the Creativity in Gaming Scale (CGS), developed in phase 2. The scale captures the three forms of creative expression, along with other circumorbital aspects of creativity including transferability and design affordances. As such, the CGS would not only serve to measure the effectiveness of digital games in facilitating creative behaviour as reported by players, but also provide guidance on what aspects of creativity are most important in the player experience. This is a useful tool for educationalists and researchers to gather insight on how different games can support player creativity, and to decide whether such games have the potential to aid in the development of circumorbital transferable skills such as problem-solving. Furthermore, it can be used by game developers to assess whether their games promote certain forms of creative expression.

### 7.2.2 Creativity as a Key Aspect of Player Experience

Secondly, this thesis provides a valuable insight into how those who play digital games define what it means to be creative. Creativity has been argued to be a highly subjective construct (Moran & John-Steiner, 2003), and what passes as creative for one individual may not necessarily be creative for another (Maslow, 1968; Richards et al., 1988). Similarly, the appearance of creativity differs extensively between domains. To the author's knowledge no literature exists that specifically examined how players define creativity within games.

As such this thesis provides a unique contribution to the field of player experience by providing an account of an important, yet often underlooked, aspect of gameplay. Previous work on player motivation and engagement such as the GameFlow Model (Sweetser & Wyeth, 2005) and the EGM (Kiili, 2005) do not explicitly account for the importance of creativity in the gaming experience. Creativity is important to players – participants volunteered to take part in the three studies to demonstrate that they felt games were creative. Those involved in the interviews and reflective photography task spoke enthusiastically about how games provided opportunities for them to be creative and to use their creative skills developed in games elsewhere.

Furthermore, by understanding what creativity looks like from a player's perspective, developers may be more attuned to designing games with player creativity in mind. Based on a player's conceptualisation of creativity, games can be designed following the unique viewpoints

outlined in this thesis, e.g. games which promote "out of the box thinking" (*ways of thinking*) or games marketed as a co-creative activity between developers and players (*games as an artform*).

In addition, those who participated in these studies were able to reflect on their own creativity in games, and what it means to them to be creative. Such reflection has enabled several participants who did not label themselves as "creative people" to re-evaluate what creativity encompasses.

This thesis provides a solid foundation for future work by illuminating the subjectivity of creativity, examining if and how conceptualisations of creativity differ between gamers and those involved in other more traditional creative pursuits, and if self-identifying as creative impacts conceptualizations (discussed further in section 8.4).

### 7.2.3 Creativity in the Learning Process

Thirdly, this thesis highlights the importance of creativity in facilitating learning. While it is beyond the remit of this thesis to conclude whether players were learning specifically from being creative or just from playing games in general, it is clear that participants considered learning and creativity as intertwined experiences. Participants spoke of learning in the same instances in which they recounted their creative activities, pointing to a close relationship between learning and creativity.

The findings suggest implications for educators with regards to providing an effective learning environment that not only allows for learning opportunities, but also for learners to be creative. If learners are given opportunities to be creative, they may not only learn more effectively, but learn more enjoyably, thus fostering intrinsic motivation.

This thesis confirmed previous findings on informal learning in digital games (e.g. Iacovides et al., 2014; Sourmelis et al., 2017; Voulgari et al., 2014) as well as suggesting additional learning outcomes in relation to creative game-based practices. A link was uncovered between the different forms of creative expression and some of the learning outcomes. These findings are envisaged to provide valuable insights for educators who wish to use digital games in their teaching and for learning technologists who hope to design creative digital mediums which promote skill development through creativity.

Although it was not the focus of this thesis to provide a definitive account of what learning outcomes can be developed as a result of playing particular games, it provides a unique contribution in terms of considering the learning outcomes that result from the different expressions of creativity, and in what particular types of games such expressions arise. As such, if

educators wished to choose a game to develop a certain learning outcome such as empathy, then they could utilise the findings from this thesis to select an existing game high in emotional challenge which caters for *creativity as affective change* such *This War of Mine* (11 Bit Studios, 2014) or the *Mass Effect* series (Bioware, 2007, 2010, 2012, 2017).

### 7.2.4 Transferability of Creativity

Fourthly, creativity has been argued to be highly transferrable (e.g. Carvalho et al., 2015; Mayer, 1989), comprising of skills such as problem-solving, cognitive flexibility and openness to experience. Educational frameworks such as 21st Century Skills (Partnership for 21st Century Skills, 2019) argue that creativity is needed for the ever changing needs of a new digital society. This thesis examined the extent of transferability of creativity between games and real-life and provided an account of what areas creativity may transfer to, what expressions of creativity were most likely to transfer (e.g. problem-solving, affective change), and which learning outcomes gained from being creative may transfer. By illuminating the flow of creativity between games and other domains of life, a unique contribution of this thesis relates to identifying aspects of creativity which are most likely to transfer between games and other areas of life.

This thesis provides implications for both educators and academics in the development of transferrable skills frameworks such as the 21st Century Learning Framework (P21) (Partnership for 21st Century Skills, 2019) and the European Commission's Digital Competence Framework (DigiComp) (Kluzer et al., 2018) with regards to the role of creativity in developing transferable learning outcomes. For example, the different forms of creativity outlined in this thesis correspond to pre-existing conceptualisations (e.g. *creativity as problem-solving* relates to Little C and creative cognition approaches), and such could be used to further refine the category of creativity in many transferrable skills frameworks.

Moreover, educators can select particular types of games that develop different forms of creativity as part of a transferrable skills curriculum. This could be achieved in various ways such as selecting games which cater for the different creative expressions, or by actively encouraging learners to reflect on their gameplay and identify and apply creative skills developed in games in other areas of their lives.

This thesis illuminates what aspects of creativity may transfer between games and real life, however, it does not provide an in-depth account of the propensity of different types of games to facilitate creative transfer. This is one area which could be expanded on in future research (see section 8.4).

### 7.2.5 Game Design for Player Creativity

Fifthly, this thesis aims to establish a link between game design elements and creative expression of players. A significant body of work exists which examines game design elements in relation to player motivation (e.g. Kiili, 2005; Sweetser & Wyeth, 2005), however, there is a dearth of literature which highlights how games can be designed to promote creativity in those who play them.

The final unique contribution of this thesis is to provide a link between aspects of game design and player creativity, in and around the game. By providing an account of how design elements may facilitate creativity in players, game designers may be able to use this information as guidance on developing games with creativity in mind. This could benefit both entertainment games and games designed specifically to foster creativity by allowing developers to specifically implement affordances which facilitate the different expressions of creativity – for example if a game was designed to cater for *creativity as appropriation,* developers could include affordances for *tools* such as a diverse and extensive range of items and abilities.

Furthermore, the different design affordances identified in this thesis may provide an initial framework of analysis for games in relation to their creative potential for players, and as such may benefit researchers in the fields of game studies and human-computer interaction. By providing an account of how game design elements can foster creative expression in players, existing games can be analysed in terms of their creative design characteristics and chosen by educators accordingly.

Overall, this thesis has demonstrated that creativity is a complex phenomenon and cannot be described from one perspective alone. Creativity in terms of digital games highlights an important aspect of player experience, consisting of a varied account of different creative expressions and reflections on gameplay, as well as aspects of game design that contribute to creative behaviour. The findings open up new avenues for future research such as investigating the relationship between creativity and learning more fully and investigating how the creative design affordances link to specific learning outcomes (discussed further in section 8.4).

## 7.3 Methodological Contributions

### 7.3.1 Narrative Survey

The first methodological contribution of this thesis is using a narrative survey within a new context; namely in the context of investigating player attitudes to creativity in digital games. Previous uses of the narrative frame method developed by Barkhuizen and Wein (2008) include

investigating the experiences of language teachers (Macalister, 2012), and the experiences of high school students learning English (Hiratsuka, 2014). Already a successful data collection method for educational experiences, the thesis provides an account of the use of this instrument in gathering self-reported data on experiences of creativity in digital games. The empirical evidence presented in this thesis ensconces the narrative survey as a successful and useful data collection tool within the context of player experience, and as a means of triangulation of data sources. Future work could use the narrative survey instrument to investigate other aspects of player experience by creating frames based on the main research constructs.

A further contribution of the narrative survey relates to its propensity as a means of reflection for participants. In this way, the use of a narrative survey as a reflective tool provides implications for educators both in relation to creativity and learning. Learners are provided with an opportunity to recount their experiences, scaffolded by the narrative frames. This could aid educators in pinpointing negative and positive aspects of the learning experience, as well as facilitating learner awareness of their own autonomy in the learning process.

### 7.3.2 Reflexive Photography

The second methodological contribution is the use of reflexive photography and photo-elicitation interviews within a new context; namely to investigate creativity in practice within the context of digital games. Reflexive photography has been predominantly used in the fields of education and sociology to investigate personal experiences, including the perspectives of children with cancer (Epstein et al., 2006), the experiences of international teaching assistants using computer-assisted language learning (Wallace, 2015) and attitudes on class habitus, identities and schooling in Buenos Aires (Inés Meo et al., 2010). In previous studies, participants have taken pictures of their physical environment, however, in the case of this thesis, participants used the integrated screen capture functions on their computers and consoles to take images of their gameplay. Such an approach addressed what can be a significant obstacle to the reflexive photography method: namely the ease of taking photographs (e.g. Schulze, 2007). By using a screenshot capture facility, participants did not face the same issues which other studies experienced in relation to physically taking photographs, and as such were minimally disrupted from their gaming activity. In this way, an ecological approach was adopted whereby players remained immersed in the activity they were documenting (e.g. by seamlessly taking screenshots as they played as opposed to having to step back and take a physical photograph).

The feedback received from participants regarding the reflexive photography method was positive, and the instrument proved effective in terms of focusing in detail on particular gaming

instances. As such, one methodological contribution is to provide empirical evidence of the use of reflexive photography within the context of player experience. The method was effective and provides implications for researchers who wish to expand upon the introduction of this method within the context of digital games and use it to investigate other aspects of the player experience.

Another contribution of the reflexive photography method relates to its use as a means of reflection for participants. The use of the reflexive photographic method provided a medium in which participants could reflect on their own creative experiences. Several participants mentioned that by taking part in the reflexive photography task they were more attuned to the ways in which games influenced their creativity. The ability of modern computers and consoles to easily take screenshots lent itself favourably to the reflexive photography method, especially in terms of providing an easily accessible manner in which participants could capture important elements of their gaming experience. Through being able to capture screenshots at any given time, participants have the opportunity to select important screenshots which they wish to reflect upon during the photo-elicitation interview. This provides implications for researchers in the use of reflexive photography for studying reflection in its own right, as well as providing implications for educators in terms of analysing learners' perceptions of their learning experiences.

### 7.3.3 A Pragmatist Approach to the Study of Creativity in Digital Games

The final methodological contribution is that of investigating creativity through a multi-method pragmatist research design. Previous studies which have examined creativity in digital games have used only one or two means to investigate the experiences of players. This thesis provides a wider account of creativity, and as such has examined the context using a multi-method approach consisting of four different methods – semi-structured interviews, a narrative survey, a quantitative survey and reflexive photography. The findings as a whole provide a rich account of creativity from the perspective of the player in terms of how creativity is conceptualised, the different forms of creative expression, and what aspects of game design contribute to player creativity. Moreover, the circumambient themes of learning and transferability have been given focus and their relationship to creativity has been expounded.

In essence, this thesis would not have been able to provide the insights it has into creativity and its surrounding themes if it was not for the use of a pragmatist research design combining both qualitative and quantitative methods. As such, future work which concerns creativity (not just in relation to digital games but also in general) could adopt a similar research design to investigate this complex, multi-faceted phenomenon.

## 7.4 Limitations

This project comprised of a mixed method analysis of creativity in digital games, with multiple steps being taken to ensure rigor and transparency of the research process. While limitations of each individual phase were covered in the relevant chapters, there were some drawbacks to the overall approach that should be considered.

The first limitation relates to the fact that all data collection methods were self-reported and relied on the accuracy of participants' recollections. While this resulted in a highly detailed account of creativity, it is subjective to those involved in the study and future studies may wish to employ more objective measures of creativity. While objective measures cannot tell us everything about creativity (which has indeed been argued to be highly subjective in itself), they may enable the results of this research to be further generalizable. One method of achieving this could be to determine the relationship between objective measures of creativity (e.g. Torrance Tests or Insight Tests) and the Creativity in Gaming Scale (CGS) developed in phase 2.

The second limitation was the gender discrepancy in participant samples for all phases. A body of work exists which suggests that creativity may differ between males and females (e.g. Hamlen, 2009; Lin et al., 2012; Yeh et al., 2016). Future studies that focus on creativity in digital games may wish to explore this area further and identify if, and how, self-reported, game-based creativity differs according to gender. This could be achieved through the use of interviews with equal numbers of both genders to determine gender specific themes and further generalised through a questionnaire. Through illuminating the role gender may play in player creativity, other aspects such as design affordances may be then considered in their relation to their propensity to facilitate creativity in different genders.

Thirdly, this project did not take into account the differences in perceptions on creativity between those who self-identified as creative and those who did not. The majority of participants in all phases engaged in creative activities outside the games, and as such the findings in this thesis may predominantly reflect the attitudes of already creative individuals. Phase 2 attempted to identify if creativity from pre-existing creative activities transferred to creativity within the game, however, as the respondent sample was already comprised of a majority of creative individuals the findings of this may be biased in favour of those who self-identify as creative. As such, a direction for future work could be to examine if, and how, attitudes to creativity in games differs depending on self-identification as creative. Furthermore, the transfer of creativity from pre-existing creative pursuits to within the game may benefit from further examination. Phase 2 provided an initial link between creative pursuits and game-based creativity, however, it did not tell us *why* or *how* particular creative hobbies contributed to different expressions of creativity. A

more qualitative follow-up might be required to provide this data, such as semi-structured interviews or focus groups, or even more of a case-study approach.

The relationship between creativity and learning still remains unclear, with both phases 1 and 2 being unable to solidly differentiate between learning from creativity and learning from games in general. In phase 1 participants spoke about creativity and learning, however, many of the learning outcomes mentioned were also learning outcomes in relation to previous work on informal game-based learning. Phase 2 attempted to be explicit in wording questions regarding learning in relation to creativity, however, as was pointed out by one respondent; it may be difficult to determine if the learning that takes place is a direct result of being creative, or just from gameplay in general. Creativity has been argued to consist of a variety of higher-level cognitive skills (e.g. Finke et al., 1992; Treffinger & Isaksen, 2005), and as such the learning taking place when one is creative may indeed mirror to some degree the skill development from general gameplay (e.g. problem-solving, reasoning). Moreover, creativity and play have been argued to be intertwined (Stebbins, 2015), which may also blur the boundary between learning outcomes associated with solely being creative and general gameplay. As such, future work may want to consider in greater detail what exactly players may learn from being creative, and if, and how this differs from learning from games in general.

A final limitation related to the wording of research questions for RQ2a, RQ2b and RQ3. RQ2a and b concerned the learning which occurs from being creative, and which aspects of creativity were transferable between domains. However, due to the nature of studies described in this thesis, any objective account of the development of learning and transferable competencies is impossible as all data collected was self-reported by participants. In this regard, all empirical evidence recounted in this thesis is the subjective interpretations of those who took part in the project. As such, future studies should take mind to consider the explicit wording of research questions to account for the self-reported nature of the research – for example, RQ2a could be re-worded from "*what do players learn from engaging in game-based creative practices?"* to "*what, if any, learning outcomes do players report from engaging in game-based creative practices?"* or "*what, if anything, do players report they learn from engaging in game-based creative practices?"*. Similarly, RQ3 "*what specific game design affordances contribute to player creativity?"* could be revised to take into account the focus on player understandings of the concept of design affordances, such as "*what specific game design affordances do players believe contribute to player creativity?*".

## 7.5 Future Work

This thesis presents a number of contributions which highlight various avenues for future work regarding creativity in digital games. Firstly, one direction of future work could be to examine if the creative forms identified in this thesis differ depending on whether a game is designed specifically with an educational goal in mind. This could be achieved by conducting a comparative study whereby one group of players are informed that a game is designed towards developing creativity, and the other group is given the game as an entertainment artefact. This would illuminate any possible framing effects such as changes or increases/decreases to player creativity, in the case of games designed with educational goals in mind. In this way, it could be illuminated if the creativity which occurs in games is more informal and implicit or goal directed and explicit – for example, when players are aware that a game is designed to support creativity are any of the creative expressions more or less common? And how does the frequency of these expressions differ in relation to more informal contexts such as entertainment games?

Secondly, future work could look to develop the Creativity in Gaming Scale (CGS) further through validation with larger and more diverse samples. Doing so would help address the sample issue in phase 2 which included a disproportionate number of males, in addition to assessing the reliability and validity of the instrument in relation to those with more diverse creative and gamer identities. A more diverse sample population could be achieved through stratified sampling – for example gaining an equal amount of both genders, those who self-identify as creative and non-creative and those who identify as different types of gamers (e.g. hardcore, moderate, casual, etc).

Thirdly, another avenue for future work could be to examine the relationship between creativity and learning in more detail and to establish whether the learning which occurs is unidirectional or bidirectional (i.e. learning occurs as a result of creativity or vice versa, or it occurs simultaneously). Furthermore, another area could be to examine reflections on creativity in terms of the learning process. This could be achieved by encouraging learners within more formal educational settings to reflect on whether they felt there was creativity involved in their learning.

Fourthly, by finding out what types of games are most likely to accommodate creative transfer, it would help to provide a list of games for educators to use specifically to teach transferrable skills. As such, one method of examining this could be through the use of a survey which specifically focuses on areas of creative transfer in relation to different game genres. In this way, the relationship between different types of games and creative transfer could be illuminated.

Finally, future work may wish to expand on the area of design affordances for creativity by using the findings of this thesis to create a more detailed framework which a) refines/updates the design affordances for different forms of creativity and b) links the affordances to specific learning outcomes. The former could be achieved through a further reflexive photographic study in addition to analysing video footage of players. The later could be achieved through the use of an experimental study using games with different types of affordances and conducting pre and post tests to measure learning outcomes.

# References


(Ukie), T. U. I. E. A. (2017). *UK Games Industry Fact Sheet 20 March 2017*. Retrieved from file:///D:/Documents/University/Researching Creative Practice/Research Material/UK Games Industry Fact Sheet 20 March 2017.pdf

11 Bit Studios. (2014). *This War of Mine*. 11 Bit Studios.

3909 LLC. (2013). *Papers, Please*. 3909 LLC.

Aarseth, E. (2007). I Fought the Law: Transgressive Play and The Implied Player. *Situated Play, Proceedings of DiGRA 2007 Conference*. Retrieved from http://www.digra.org/wp-content/uploads/digital-library/07313.03489.pdf

Aarseth, E. (2012). A Narrative Theory of Games. *FDG'12 May 29-June 1*. https://doi.org/10.1145/2282338.2282365

Adachi, P. J. C., & Willoughby, T. (2013). More Than Just Fun and Games: The Longitudinal Relationships Between Strategic Video Games, Self-Reported Problem Solving Skills, and Academic Grades. *Journal of Youth and Adolescence*, *42*(7), 1041–1052. https://doi.org/10.1007/s10964-013-9913-9

Adams, A., Lunt, P., & Cairns, Paul. (2008). A qualitative approach to HCI research. In P. Cairns & A. Cox (Eds.), *Research Methods for Human–Computer Interaction* (pp. 138–157). https://doi.org/10.1017/cbo9780511814570.008

Adams, E. (2014). *Fundamentals of game design*. Pearson Education.

Alahuhta, P., Nordbäck, E., Sivunen, A., & Surakka, T. (2014). Fostering Team Creativity in Virtual Worlds. *Journal For Virtual Worlds Research*, *7*(3). https://doi.org/10.4101/jvwr.v7i3.7062

Alonso-Díaz, L., Yuste-Tosina, R., & Mendo-Lázaro, S. (2019). Adults video gaming: Key competences for a globalised society. *Computers and Education*, *141*. https://doi.org/10.1016/j.compedu.2019.103616

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, *43*(5), 997–1013. https://doi.org/10.1037/0022-3514.43.5.997

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, *45*(2), 357–376.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in Organizational Behavior*, *10*, 123–167.

Amabile, T. M. (1990). Within you, without you: The social psychology of creativity, and beyond. In M. A. Runco & R. S. Albert (Eds.), *Theories of Creativity*. Newbury Park, CA: Sage Publications.

Amabile, T. M. (1996). *Creativity in context*. Boulder, CO: Westview Press.

Amabile, T. M., & Gryskiewicz, N. D. (1989). The creative environment scales: Work environment inventory. *Creativity Research Journal*, *2*(4), 231–253. https://doi.org/10.1080/10400418909534321

Arieti, S. (1976). *Creativity: The Magic Synthesis*. Oxford: Basic Books.

Arkane Studios. (2012). *Dishonoured*. Bethseda Softworks.

Atari. (1972). *Pong*. Atari.

Atlus. (2016). *Persona 5*. Atlus.

Baer, J. (1998). The Case for Domain Specificity of Creativity. *Creativity Research Journal*, *11*(2), 173–177. Retrieved from http://users.rider.edu/~baer/CaseforSpecificity.pdf

Baer, J. (2016). Domain Specificity: Introduction and Overview. In *Domain Specificity of Creativity*. San Diego: Elsevier Ltd.

Baer, J., & McKool, S. S. (2009). Assessing Creativity Using the Consensual Assessment Technique. *Handbook of Research on Assessment Technologies, Methods, and Applications in Higher Education*, 65–77. https://doi.org/10.4018/978-1-60566-667-9.ch004

Bailey, R., Wise, K., & Bolls, P. (2009). How Avatar Customizability Affects Children's Arousal and Subjective Presence During Junk Food–Sponsored Online Video Games. *CyberPsychology & Behavior*, *12*(3), 277–283. https://doi.org/10.1089/cpb.2008.0292

Banks, J. (2013). *Human-technology relationality and self-network organization: Players and avatars in World of Warcraft*. Fort Collins, CO: Colorado State University.

Barkhuizen, G. (2014). Revisiting narrative frames: An instrument for investigating language teaching and learning. *System*, *47*, 12–27. https://doi.org/10.1016/j.system.2014.09.014

Barkhuizen, G., & Wette, R. (2008). Narrative frames for investigating the experiences of language teachers. *System*, *36*(3), 372–387. https://doi.org/10.1016/j.system.2008.02.002

Barr, M. (2017). Video games can develop graduate skills in higher education students: A randomised trial. *Computers & Education*, *113*, 86–97. https://doi.org/10.1016/J.COMPEDU.2017.05.016

Barr, M. (2018). Student attitudes to games-based skills development: Learning from video games in higher education. *Computers in Human Behavior*, *80*, 283–294. https://doi.org/10.1016/j.chb.2017.11.030

Barr, M. (2020). A cross-sectional study of video game play habits and graduate skills attainment. *Research in Learning Technology*, *28*, 2020. https://doi.org/10.25304/rlt.v28.2326

Barr, P., Noble, J., & Biddle, R. (2007). Video Game Values: Play as Human–Computer Interaction. *Interacting with Computers*, *19*(2), 180–195. https://doi.org/10.1016/j.intcom.2006.08.008

Bartsch, A., & Hartmann, T. (2017). The Role of Cognitive and Affective Challenge in Entertainment Experience. *Communication Research*, *44*(1), 29–53. https://doi.org/10.1177/0093650214565921

Baughman, W. A., & Mumford, M. D. (1995). Process-Analytic Models of creative Capacities: Operations Influencing the Combination-and-Reorganization Process. *Creativity Research Journal*, *8*(1), 37–62. https://doi.org/10.1207/s15326934crj0801_4

Beavers, S. (2019). *The Informal learning of History with Digital Games*. The Open University.

Behr, K.-M., Huskey, R., & Weber, R. (2016). Creative Interactivity. In *Video Games and Creativity*. https://doi.org/10.1016/b978-0-12-801462-2.00014-x

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House*, *83*, 39–43. https://doi.org/10.1080/00098650903505415

Bender, D. E., Harbour, C., Thorp, J., & Morris, P. (2001). Tell Me What You Mean by "Sí": Perceptions of Quality of Prenatal Care Among Immigrant Latina Women. *QUALITATIVE*

*HEALTH RESEARCH*, *11*(6), 780–794.

Bethesda. (2011). *The Elder Scrolls: Skyrim*.

Bethesda Game Studios. (2011). *The Elder Scrolls V: Skyrim*. Bethesda Softworks.

Bethesda Game Studios. (2015). *Fallout 4*. Bethseda Softworks.

Bethesda Game Studios. (2018). *Fallout 76*. Bethesda Softworks.

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGraw, & E. Care (Eds.), *Assessment and Teaching of 21st Century Skills* (pp. 17–66). https://doi.org/10.1007/978-94-007-2324-5_2

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., & Runmble, M. (2014). *Partnership for 21st Century Skills*.

Bioware. (2007). Mass Effect. *Electronic Arts*.

Bioware. (2009). *Dragon Age: Origins*.

Bioware. (2010). *Mass Effect 2*. Electronic Arts.

Bioware. (2011). *Dragon Age II*. Electronic Arts.

Bioware. (2012). *Mass Effect 3*. Electronic Arts.

Bioware. (2014). *Dragon Age: Inquisition*. Electronic Arts.

Bioware. (2017). *Mass Effect: Andromeda*. Electronic Arts.

Bithell Games. (2012). *Thomas Was Alone*. Bithell Games.

Blanco-Herrera, J. A., Gentile, D. A., & Rokkum, J. N. (2019). Video Games can Increase Creativity, but with Caveats. *Creativity Research Journal*, *31*(2), 119–131. https://doi.org/10.1080/10400419.2019.1594524

Blandford, A. (2013). Semi-Structured Qualitative Studies. *The Encyclopedia of Human-Computer Intreraction*, *2*, 53. Retrieved from http://www.interaction-design.org/encyclopedia/semi-structured_qualitative_studies.html

Blascovich, J., & Bailenson, J. (2011). *Infinite reality: The hidden blueprint of our virtual lives*. New York: Harper Collins.

Blizzard Entertainment. (2002). *Warcraft III: Reign of Chaos*. Blizzard Entertainment.

Blizzard Entertainment. (2004). *World of Warcraft (WoW)*. Blizzard Entertainment.

Blizzard Entertainment. (2010). *Starcraft II*. Blizzard Entertainment.

Blizzard Entertainment. (2014). *Hearthstone*. Blizzard Entertainment.

Blumberg, F. C., Rosenthal, S. F., Randall, John D, & Randall, J D. (2008). Impasse-driven learning in the context of video games q. *Computers in Human Behavior*, *24*, 1530–1541. https://doi.org/10.1016/j.chb.2007.05.010

Bogost, I. (2011). *How to do things with videogames*. Minneapolis: University of Minnesota Press.

Bopp, J. A., Opwis, K., & Mekler, E. D. (2018). An Odd Kind of Pleasure: Differentiating Emotional Challenge in Digital Games. *CHI 2018 April 21-26*. https://doi.org/10.1145/3173574.3173615

Bowman, N. D., Kowert, R., & Ferguson, C. J. (2015). The Impact of Video Game Play on Human (and Orc) Creativity. In G. P. Green & J. C. Kaufman (Eds.), *Video Games and Creativity* (pp. 39–60). https://doi.org/10.1016/B978-0-12-801462-2.00002-3

Bowman, R. F. (1982). A Pac-Man theory of motivation. Tactical implications for classroom instruction. *Educational Technology*, *22*(9), 14–17.

Boyle, E. A., Connolly, T. M., & Hainey, T. (2011). The role of psychology in understanding the impact of computer games. *Entertainment Computing*, *2*, 69–74. Retrieved from http://ac.els-cdn.com/S1875952110000200/1-s2.0-S1875952110000200-main.pdf?_tid=dbefa708-244f-11e7-9d9f-00000aab0f27&acdnat=1492531287_0feb8db433eb4de83f2a0f06be79a01b

Boyle, E. A., Hainey, T., Connolly, T. M., Gray, G., Earp, J., Ott, M., … Ao Pereira, J. ~. (2016). An update to the systematic literature review of empirical evidence of the impacts and outcomes of computer games and serious games. *Computers and Education*, *94*, 178–192. https://doi.org/10.1016/j.compedu.2015.11.003

Bransford, J., & Stein, B. (1993). The Ideal Problem Solver. In *Centers for Teaching and Technology - Book Library*. Retrieved from https://digitalcommons.georgiasouthern.edu/ct2-library/46

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, J. S., Collins, A., & Duguld, P. (1988). Situated Cognition and the culture of learning. *Educational Researcher*, *Report # 6*(December), 1–30. https://doi.org/10.3102/0013189X018001032

Burri, M. (2011). Misunderstanding Creativity: User Created Content in Virtual Worlds and Its Constraints by Code and Law. *International Journal of Communications Law & Policy*, *14*(March), 1–28.

Bytheway, J. (2015). A taxonomy of vocabulary learning strategies used in massively multiplayer online role-playing games. *CALICO Journal*, *32*(3), 508–527. https://doi.org/10.1558/cj.v32i3.26787

Caillois, R., & Barash, M. (1958). *Man, play, and games*. University of Illinois Press.

Calleja, G. (2011). *In-game: From immersion to incorporation*. MIT Press.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, *56*(2), 81.

Capcom. (2001). *Breath of Fire*. Squaresoft.

Capcom. (2018). *Monster Hunter: World*. Capcom.

Capcom, & Double Helix Games. (2014). *Strider*. Capcom, Double Helix Games.

Cardona-Rivera, R. E., & Young, R. M. (2013). A Cognitivist Theory of Affordances for Games. *Proceedings of DiGRA 2013*. Retrieved from http://www.digra.org/wp-content/uploads/digital-library/paper_74b.pdf.pdf

Carvalho, M. B., Bellotti, F., Berta, R., De Gloria, A., Sedano, C. I., Hauge, J. B., … Rauterberg, M. (2015). An activity theory-based model for serious games analysis and conceptual design. *Computers and Education*, *87*, 166–181. https://doi.org/10.1016/j.compedu.2015.03.023

Castronova, E. (2008). *Exodus to the Virtual World: How Online Fun is Changing Reality*. New York: St. Martin's Griffin.

Cattell, R. B. (1973). *Factor analysis*. Westport, CT: Greenwood Press.

CD Projekt Red. (2007). *The Witcher*. CD Projekt Red.

CD Projekt Red. (2011). *The Witcher 2: Assassins of Kings*. CD Projekt Red.

CD Projekt Red. (2015). *The Witcher 3: Wild Hunt*. CD Projekt Red.

Charmaz, K. (2006). The Power of Names. *Journal of Contemporary Ethnography*, *35*(4), 396–399. https://doi.org/10.1177/0891241606286983

Charsky, D. (2010). From edutainment to serious games-a change in the use of game characteristics. *Games and Culture*, *5*, 177–198.

Chik, A. (2014). DIGITAL GAMING AND LANGUAGE LEARNING: AUTONOMY AND COMMUNITY. *Language Learning & Technology*, *18*(182), 85–100. Retrieved from http://llt.msu.edu/issues/june2014/chik.pdf

Child, D. (2006). *The essentials of factor analysis (3rd Edition)*. New York: Continuum International Publishing Group.

Chuang, T. Y., Zhi-Feng Liu, E., & Shiu, W. Y. (2015). Game-based creativity assessment system: the application of fuzzy theory. *Multimedia Tools and Applications*, *74*(21), 9141–9155. https://doi.org/10.1007/s11042-014-2070-7

Clarke, A., & Mitchell, G. (2007). *Video games and art*. Bristol: UK: Intellect.

Clough, G., & Ferguson, R. (2010). Virtual worlds are authentic sites for learning. *Virtual Worlds: Controversies at the Frontier of Education*. Retrieved from https://www.novapublishers.com/catalog/product

Codemasters. (2018). *Onrush*. Deep Silver,.

Cohen, P., West, S. G., & Aiken, L. S. (1983). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. https://doi.org/10.4324/9781410606266

Cole, T., Cairns, P., & Gillies, M. (2015). Emotional and Functional Challenge in Core and Avant-garde Games. *CHI Play 2015 October 3-7*. https://doi.org/10.1145/2793107.2793147

Colossal Order Ltd. (2015). Cities: Skylines. *Colossal Order Ltd.*

ConcernedApe. (2016). *Stardew Valley*. ConcernedApe.

Consalvo, M. (2009). *Cheating: Gaining Advantage in Videogames*. London: MIT Press.

Coombs, P. H., & Ahmed, M. (1974). *Attacking Rural Poverty: How Nonformal Education Can Help*. Baltimore: John Hopkins University Press.

Cooper, A. (1999). *The inmates are running the asulum. Why high-tech products drive us crazy and how to restore the sanity* (Second (20). Indianapolis: Sams.

Costall, A. (2012). Canonical Affordances in Context. *AVANT*, *III*(2), 85–93. https://doi.org/10.1109/SMC.2015.200

Cox, A. ., Cairns, P., Shah, P., & Carroll, M. (2012). Not Doing But Thinking: The Role of Challenge in the Gaming Experience. *CHI 2012, May 5–10, 2012, Austin, Texas, USA*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.261.3380&rep=rep1&type=pdf

Craft, A. (2000). *Creativity across the primary curriculum: Framing and developing practice*. London: Routledge.

Craft, A. (2005). *Creativity in schools: Tensions and dilemmas*. New York: Abingdon: Routledge.

Creative Assembly. (2014). *Alien: Isolation*. Sega.

Creswell, J. W. (2013). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. In *Sage Publications*. https://doi.org/10.1007/s13398-014-0173-7.2

Cseh, G. M., Phillips, L. H., & Pearson, D. G. (2015). Flow, affect and visual creativity. In *Cognition and Emotion* (Vol. 29). https://doi.org/10.1080/02699931.2014.913553

Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. New York: Harper & Row.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the Psychology of Discovery and Invention*. https://doi.org/10.1037/e586602011-001

Csikszentmihalyi, M. (1999). Implications of a Systems Perspective for the Study of Creativity. In R. J. Sternberg (Ed.), *Handbook of Creativity* (pp. 313–335). Cambridge, NY: Cambridge University Press.

Csikszentmihalyi, M., & Hermanson, K. (1995). Intrinsic motivation in museums: What makes visitors want to learn? *Museum News*, *74*, 34–37, 59–61.

Curwood, J. S., Magnifico, A. M., & Lammers, J. C. (2013). Writing in the wild: Writers' motivation in fan-based affinity spaces. *Journal of Adolescent and Adult Literacy*, *56*(8), 677–685. https://doi.org/10.1002/JAAL.192

de Winter, J. C. F., Dodou, D., & Wieringa, P. A. (2009). Exploratory factor analysis with small sample sizes. *Multivariate Behavioral Research*, *44*(2), 147–181. https://doi.org/10.1080/00273170902794206

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*(2), 109–134. https://doi.org/10.1016/0092-6566(85)90023-6

Deck Nine. (2017). *Life is Strange: Before the Storm*. Square Enix,.

Dede, C. (2009). Comparing Frameworks for 21 st Century Skills. *Harvard Graduate School of Education* . Retrieved from https://pdfs.semanticscholar.org/12f9/e550e1e0a3a1eb4cbcc3e10279bedcb017aa.pdf

Degele, N. (1997). Appropriation of Technology as a Creative Process. *Creativity and Innovation Management*, *6*(2), 89–93. https://doi.org/10.1111/1467-8691.00054

Denisova, A., Guckelsberger, C., & Zendle, D. (2017). Challenge in Digital Games: Towards Developing a Measurement Tool. *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, 2511–2519. https://doi.org/10.1145/3027063.3053209

Deterding, S. (2011). Situated motivational affordances of game elements : A conceptual model. *CHI 2011*. Retrieved from https://www.researchgate.net/publication/303084050

Dickey, M. D. (2007). Game design and learning: a conjectural analysis of how massively multiple online role-playing games (MMORPGs) foster intrinsic motivation. *Education Tech Research Dev*, *55*, 253–273. https://doi.org/10.1007/s11423-006-9004-7

Digital Extremes. (2012). *The Darkness II*. 2K Games.

DONTNOD Entertainment. (2015). *Life is Strange*. Square Enix.

Douglas, K. B. (1998). Seeing as Well as Hearing: Responses to the Use of an Alternative Form of Data Representation in a Study of Students' Environmental Perceptions. *ASHE Annual Meeting Paper*. Retrieved from https://eric.ed.gov/?id=ED427565

Driskell, J. E., & Dwyer, D. J. (1984). Microcomputer Videogame Based Training. *Educational Technology*, Vol. 24, pp. 11–16. https://doi.org/10.2307/44427307

Economides, A. A., & Perifanou, M. A. (2018). MOOC Affordances Model. *2018 IEEE Global Engineering Education Conference (EDUCON) 17-20 April, Santa Cruz de Tenerife, Canary Islands, Spain*.

Efron, B., & Tibshirani, R. J. (1994). *An Introduction to the Bootstrap*. Retrieved from https://cds.cern.ch/record/526679/files/0412042312_TOC.pdf

Epstein, I., Mn, R., Stevens, B., Mckeever, P., Phd, R., & Baruchel, S. (2006). Photo Elicitation Interview (PEI): Using Photos to Elicit Children's Perspectives. *International Journal of Qualitative Methods*, *5*(53). Retrieved from http://www.ualberta.ca/~iiqm/backissues/5_3/pdf/

ESA. (2017). 2017: Sales, Demographics and Usage Data.

ESA. (2019). *2019 Essential Facts About the Computer and Video Game Industry*. Retrieved from https://www.theesa.com/wp-content/uploads/2019/05/ESA_Essential_facts_2019_final.pdf

Eshach, H. (2007). Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. *Journal of Science Education and Technology*, *16*(2), 171–190. https://doi.org/10.1007/s10956-006-9027-1

Eul, SteveFreak, & IceFrog. (2003). *Defense of The Ancients (DOTA)*.

Ferguson, C. J., & Olson, C. K. (2013). Friends, fun, frustration and fantasy: Child motivations for video game play. *Motivation and Emotion*, *37*(1), 154–164. https://doi.org/10.1007/s11031-012-9284-7

Ferguson, R. (2011). Meaningful learning and creativity in virtual worlds. *Thinking Skills and Creativity*, *6*, 169–178. https://doi.org/10.1016/j.tsc.2011.07.001

Field, A. (2009). *Discovering Statistics Using SPSS 3rd Edition*. London: SAGE Publications Ltd.

Finke, R. A. (1996). Imagery, Creativity, and Emergent Structure. In *CONSCIOUSNESS AND COGNITION* (Vol. 5). Retrieved from https://ac.els-cdn.com/S1053810096900240/1-s2.0-S1053810096900240-main.pdf?_tid=aa701baf-27db-4e15-9904-6f40e49c2fd6&acdnat=1549490224_efde9c9a454d27b6c6421a86501303c3

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative Cognition: Theory, Research and Applications*. Cambridge, MA: MIT Press.

Finke, R. A., Ward, T. B., & Smith, S. M. (1999). Creative Cognition. In R. J. Sternberg (Ed.), *Handbook of Creativity* (pp. 189–212). Cambridge University Press.

Fischer, P., Greitemeyer, T., Morton, T., Kastenmüller, A., Postmes, T., Frey, D., … Odenwälder, J. (2009). The racing-game effect: Why do video racing games increase risk-taking inclinations? *Personality and Social Psychology Bulletin*, *35*(10), 1395–1409. https://doi.org/10.1177/0146167209339628

Fleck, R. (2008). *Exploring the potential ofpassive image capture to support reflection on experience*. University of Sussex.

Fleck, R., & Fitzpatrick, G. (2010). Reflecting on reflection: Framing a design landscape. *OZCHI*

*2010, November 22-26*. https://doi.org/10.1145/1952222.1952269

Franklin, S. (2018). 10 Genre Defining Video Games (And How They Did It). Retrieved February 19, 2019, from Gamasutra website: https://gamasutra.com/blogs/SamuelFranklin/20181001/327624/10_Genre_Defining_Video_Games_And_How_They_Did_It.php

Fraxis, & Aspyr. (2016). *Civilisation VI*. 2K.

Frictional Games. (2015). *SOMA*. Frictional Games.

FromSoftware. (2011). *Dark Souls*. Namco Bandai.

Frontier Developments. (2016). *Planet Coaster*. Frontier Developments.

Funcom. (2017). *The Secret World: Legends*. Funcom, Electronic Arts.

Game Freak. (1996). *Pokemon Red and Blue*. Nintendo.

Ganglbauer, E., & Fitzpatrick, G. (2015). Why and what did we throw out? Probing on Reflection through the Food Waste Diary. *CHI 2015 Sustainability & Recycling*. https://doi.org/10.1145/2702123.2702284

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, Motivation, and Learning: A Research and Practice Model. *Simulation & Gaming* , *33*(441). https://doi.org/10.1177/1046878102238607

Gee, J. P. (2003a). What video games have to teach us about learning and literacy. *Computers in Entertainment*, *1*(1), 20. https://doi.org/10.1145/950566.950595

Gee, J. P. (2003b). *What Video Games have to teach us about Learning and Literacy*. Retrieved from https://s3.amazonaws.com/academia.edu.documents/37415875/What_Video_Games_Have_to_Teach_us_About_Learning_and_Literacy.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1523982518&Signature=CEVKKb5hrZg3PTNrKH12XbaG5Sg%253D&response-content-disposition=inline%25

Gee, J. P. (2005). Why are videogames good for learning? *Spectrum*, *32*, 25–32. Retrieved from http://cmslive.curriculum.edu.au/leader/default.asp?id=16866&issueID=10696

Gee, J. P. (2008). Learning and games. In K. Salen (Ed.), *The ecology of games: Connecting youth, games, and learning* (pp. 21–40). Cambridge: MIT Press.

Genius Sonority. (2015). *Pokemon Shuffle*. Nintendo 3DS.

Gentner, D. (1989). The Mechanisms of Analogical Learning. In S. Vosniadou & O. Ortony (Eds.), *Similarity and Analogical Reasoning*. Retrieved from https://apps.dtic.mil/dtic/tr/fulltext/u2/a187256.pdf

Gerber, B. L., Cavallo, A. M. L., & Marek, E. A. (2001). Relationships among informal learning environments, teaching procedures and scientific reasoning ability. *International Journal of Science Education*, *23*(5), 545–549.

Getzels, J. W., & Csikszentmihalyi, M. (1976). *The creative vision: a longitudinal study of problem finding in art*. Retrieved from http://www.openbibart.fr/item/display/10068/1132946

Giant Margarita. (2016). *Party Golf*. Giant Margarita,.

Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford (Eds.), *Perceiving, Acting*

*and Knowing*. Hillsdale, NJ: Erlbaum.

Gie Yong, A., & Pearce, S. (2013). A Beginner's Guide to Factor Analysis: Focusing on Exploratory Factor Analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79–94. Retrieved from http://www.tqmp.org/RegularArticles/vol09-2/p079/p079.pdf

Glaser, B., & Strauss, A. (1967). *The discovery of Grounded Theory*. Chicago: Aldine.

Glăveanu, V. P. (2012). What can be done with an egg? Creativity, material objects, and the theory of affordances. *Journal of Creative Behavior*, *46*(3), 192–208. https://doi.org/10.1002/jocb.13

Glăveanu, V. P. (2013). Rewriting the language of creativity: The five A's framework. *Review of General Psychology*, *17*(1), 69–81. https://doi.org/10.1037/a0029528

Glucksberg, S., & McCloskey, M. (1981). Decisions about ignorance: Knowing that you don't know. *Journal of Experimental Psychology: Human Learning and Memory*, *7*(5), 311–325. https://doi.org/10.1037/0278-7393.7.5.311

Grabe, M., & Grabe, C. (1998). *Integrating technology for meaningful learning*. Boston: Houghton Mifflin.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a Conceptual Framework for Mixed-Method Evaluation Designs. *EDUCATIONAL EVALUATION AND POLICY ANALYSIS*, *11*(255). https://doi.org/10.3102/01623737011003255

Greeno, J. G. (1978). Natures of problem-solving abilities. *Handbook of Learning and Cognitive Processes*, *5*, 239–270.

Griffiths, M., & Light, B. (2008). Social Networking and Digital Gaming Media Convergence: Classification and its Consequences for Appropriation. *Information Systems Frontiers*, *10*(4447–459). Retrieved from www.danah.org.

Grodal, T. (2000). Video Games and the Pleasures of Control. In *Media Entertainment: The Psychology of its Appeal* (p. 296). Retrieved from https://books.google.com/books?hl=en&lr=&id=ZRyQAgAAQBAJ&pgis=1

Hamlen, K. R. (2009). Relationships between Computer and Video Game Play and Creativity among Upper Elementary School Students. *Journal of Educational Computing Research*, *40*(1), 1–21. https://doi.org/10.2190/EC.40.1.a

Hamlen, K. R., & Blumberg, F. C. (2015). Problem Solving Through "Cheating" in Video Games. In G. P. Green & J. C. Kaufman (Eds.), *Video Games and Creativity* (pp. 83–97). https://doi.org/10.1016/B978-0-12-801462-2.00004-7

Hampton, J. A. (1987). Inheritance of attributes in natural concept conjunctions. *Memory & Cognition*, *15*(1), 55–71. https://doi.org/10.3758/BF03197712

Harper, D. (1994). On the Authority of Image - Visual Methods at the Crossroads. *Handbook of Qualitative Research*, 403–412.

Heinzen, T. (1994). Situational affect: proactive and reactive creativity. In M. A. Runco & M. Shaw (Eds.), *Creativity and Affect* (pp. 127–46). Norwood, NJ: Ablex.

Heisley, D. D., & Levy, S. J. (1991). Autodriving: A Photoelicitation Technique. *Journal of Consumer Research*, *18*(3), 257. https://doi.org/10.1086/209258

Hélie, S., & Sun, R. (2010). Incubation in Insight Problem Solving A UNIFIED THEORY AND A CONNECTIONIST MODEL. *Psychological Review*, *117*(3), 994–1024. Retrieved from

http://www.tandfonline.com/doi/abs/10.1207/s15326934crj1601_13%5Cnhttp://psycnet.apa.org/journals/rev/117/3/994/

Hennessey, B. a., & Amabile, T. M. (1998). Reality, intrinsic motivation, and creativity. *American Psychologist*, *53*(6), 674–675. https://doi.org/10.1037/0003-066X.53.6.674

Henriksen, T. D. (2006). Games and Creativity Learning. In T. Fritzon & T. Wrigstad (Eds.), *Role, Play, Art: Collected Experiences of Role-Playing* (pp. 3–15). Stockholm: Föreningen Knutpunkt.

Herodotou, C. (2009). *Game Appropriation: Where does the gamer fit?* (University of London). Retrieved from http://oro.open.ac.uk/49459/1/My thesis FINAL_april2009.pdf

Herodotou, C., Winters, N., & Kambouri, M. (2012). A Motivationally Oriented Approach to Understanding Game Appropriation. *International Journal of Human-Computer Interaction*, *28*(1), 34–47. https://doi.org/10.1080/10447318.2011.566108

Herodotou, C., Winters, N., & Kambouri, M. (2014). An Iterative, Multidisciplinary Approach to Studying Digital Play Motivation: The Model of Game Motivation. *Games and Culture*, *10*(3), 249–268. https://doi.org/10.1177/1555412014557633

Hill, L. (2014). "Some of it I haven't told anybody else": Using photo elicitation to explore the experiences of secondary school education from the perspective of young people with a diagnosis of Autistic Spectrum Disorder. *Educational and Child Psychology*, *31*(1), 79–89. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc11&NEWS=N&AN=2014-17093-007

Hiratsuka, T. (2014). A study into how high school students learn using narrative frames. *ELT Journal*, *68*(2), 169–178. https://doi.org/10.1093/elt/cct096

Hong, N. S. (1998). The Relationship Between Well-Structured and Ill-Structured Problem Solving in Multimedia Simulation. https://doi.org/10.16953/deusbed.74839

Hsiao, H. S., Chang, C. S., Lin, C. Y., & Hu, P. M. (2014). Development of children's creativity and manual skills within digital game-based learning environment. *Journal of Computer Assisted Learning*, *30*(4), 377–395. https://doi.org/10.1111/jcal.12057

Hsu, S. H., Kao, C.-H., & Wu, M.-C. (2007). Factors Influencing Player Preferences for Heroic Roles in Role-Playing Games. *CyberPsychology & Behavior*, *10*(2), 293–295. https://doi.org/10.1089/cpb.2006.9955

Hsu, S. H., Lee, F. L., & Wu, M. C. (2005). Designing action games for appealing to buyers. *Cyberpsychology and Behavior*, *8*(6), 585–591. https://doi.org/10.1089/cpb.2005.8.585

Hulstijn, J. H. (2002). Incidental and Intentional Learning. In *Handbook of Second Language Acquisition* (pp. 1–26). Malden, MA: Blackwell.

Hunicke, R., Leblanc, M., & Zubek, R. (2004). *MDA: A Formal Approach to Game Design and Game Research*. Retrieved from http://www.aaai.org/Papers/Workshops/2004/WS-04-04/WS04-04-001.pdf?utm_source=cowlevel

Iacovides, I. (2012). *Digital games: motivation, engagement and informal learning*. The Open University.

Iacovides, I., Cox, A. L., Avakian, A., & Knoll, T. (2014). Player Strategies: Achieving Breakthroughs and Progressing in Single-Player and Cooperative Games. *Proceedings of the First ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '14*, 131–140.

https://doi.org/10.1145/2658537.2658697

Iacovides, I., Cox, A. L., Mcandrew, P., Aczel, J., & Scanlon, E. (2015). Game-play breakdowns and breakthroughs: Exploring the relationship between action, understanding and involvement. *Human–Computer Interaction*, *30*, 3–4. https://doi.org/10.1080/07370024.2014.987347

Iacovides, I., McAndrew, P., Scanlon, E., & Aczel, J. (2014). the Gaming Involvement and Informal Learning Framework. *Simulation & Gaming*, *45*(4–5), 611–626. https://doi.org/10.1177/1046878114554191

Inés Meo, A., Lambert, C., Parker, A., Dabenigno, V., Rayment, J., Wakeling, P., & Caanan, J. (2010). Picturing Students' Habitus: The Advantages and Limitations of Photo-Elicitation Interviewing in a Qualitative Study in the City of Buenos Aires. *International Journal of Qualitative Methods*, *9*(2). Retrieved from http://journals.sagepub.com/doi/pdf/10.1177/160940691000900203

Infinity Ward. (2009). *Call of Duty: Modern Warfare 2*. Activision.

ISFE. (2019, September 12). Games in Society. https://doi.org/10.3389/fnhum.2018.00047

Jackson, L. A. (2012). The Upside of Videogame Playing. *Games for Health Journal*, *1*(6), 452–455. https://doi.org/10.1089/g4h.2012.0064

Jackson, L. A., & Games, A. I. (2015). Video Games and Creativity. In G. P. Green & J. C. Kaufman (Eds.), *Video Games and Creativity* (pp. 1–309). https://doi.org/10.1016/C2014-0-00065-2

Jackson, L. A., Witt, E. A., Games, A. I., Fitzgerald, H. E., von Eye, A., & Zhao, Y. (2012). Information technology use and creativity: Findings from the Children and Technology Project. *Computers in Human Behavior*, *28*(2), 370–376. https://doi.org/10.1016/j.chb.2011.10.006

Jarrett, J. (2014). Fountain Hooks, Emergent Exploits and the Playful Co-Creativity of MOBAs. *Videogame Cultures and the Future of Interactive Entertainment 6th Global Conference, July 19th 2014*. Oxford.

Jarrett, J. (2015). Playing Between Rules : Negotiating the Ludic Innovations of the MOBA genre. *DiGRA 2015: Diversity of Play*.

Jarrett, J. (2016). *Critically Approaching the Playful and Participatory Genealogy of MOBAs*. 1–16.

Järvinen, A. (2008). *Games without Frontiers: Theories and Methods for Game Studies and Design* (University of Tampere, Finland). Retrieved from http://acta.uta.fi

Jenkins, H. (2004). Game Design as Narrative Architecture. In N. Wardrip-Fruin & P. Harrigan (Eds.), *FirstPerson: New Media as Story, Performance, and Game*. Retrieved from http://blogs.bgsu.edu/honors1120/files/2013/08/Jenkins_Narrative_Architecture.pdf

Johnson, R. W. (2001). An Introduction to the Bootstrap. *Teaching Statistics*, *23*(2). Retrieved from https://onlinelibrary.wiley.com/doi/pdf/10.1111/1467-9639.00050

Jonassen, D. H., Howland, J. L., Moore, J. L., & Marra, R. M. (2003). *Learning to solve problems with technology : a constructivist perspective*. Retrieved from https://archive.org/details/learningtosolvep00jona%0Ahttps://archive.org/stream/learningtosolvep00jona#page/n3/search/learning

Jones, R. M., & Vanlehn, K. (1994). Acquisition of Children's Addition Strategies: A Model of Impasse-Free, Knowledge-Level Learning. *Machine Learning*, *16*(1/2), 11–36. https://doi.org/10.1023/A:1022626701243

Juul, J. (2002). The Open and the Closed: Game of emergence and games of progression. *In Proc.*

*Computer Game and Digital Cultures*, 323–329.

Juul, J. (2005). *Half-Real: Video Games between Real Rules and Fictional Worlds*. Cambridge, MA: MIT Press.

Kaptelinin, V., & Nardi, B. A. (2012). Affordances in HCI: toward a mediated action perspective. *Proceedings of the 2012 ACM Annual Conference on Human Factors in Computing Systems*, 967–976. https://doi.org/10.1145/2208516.2208541

Kaufman, J. C., & Beghetto, R. a. (2009). Beyond Big and Little: The Four C Model of Creativity. *Review of General Psychology*, *13*(1), 1–12. https://doi.org/10.1037/a0013688

Kerr, B., & Gagliardi, C. (2003). Measuring Creativity in Research and Practice. In S. J. Lopez & C. R. Snyder (Eds.), *Positive psychological assessment: A handbook of models and measures.* (pp. 155–169). Washington: DC: American Psychological.

Khaled, R. (2018). Questions Over Answers: Reflective Game Design. In *Playful Disruptions of Digital Media* (pp. 3–27). https://doi.org/10.1007/978-981-10-1891-6_1

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *Internet and Higher Education*, *8*(1), 13–24. https://doi.org/10.1016/j.iheduc.2004.12.001

Kim, Y. J., & Shute, V. J. (2015). Opportunities and Challenges in Assessing and Supporting Creativity in Video Games. In *Video Games and Creativity*. https://doi.org/10.1016/B978-0-12-801462-2.00005-9

King. (2012). *Candy Crush Saga*. King.

Klei Entertainment. (2017). *Oxygen Not Included*. Klei Entertainment,.

Kline, P. (1994). *An Easy Guide to Factor Analysis*. London: Routledge.

Kline, P. (1999). *The handbook of psychological testing (2nd Edition)*. London: Routledge.

Kluzer, S., Pujol Priego, L., Carretero, S., Punie, Y., Vuorikari, R., & Cabrera, Marcelino; Keeffe, W. (2018). *DigComp into action, get inspired make it happen: A user guide to the European Digital Competence framework.* https://doi.org/10.2760/112945

Konami. (2004). *Metal Gear Solid 3: Snake Eater*. Konami.

Kozbelt, A., Begheuo, R. A., & Runco, M. A. (2010). Theories of Creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge Handbook of Creativity*. Retrieved from https://static1.squarespace.com/static/52d6f16be4b0770a479dfb9c/t/53bfc77be4b04e5d54cfb085/1405077371508/ThryCrty%28KozbeltBeghettoRunco%2C2010%29.pdf

Krosnick, J. A., & Presser, S. (2010). Question and Questionnaire Design. In *Handbook of Survey Research, Second Edition* (pp. 263–313). https://doi.org/10.1111/j.1432-1033.1976.tb10115.x

Lastowka, G. (2012). Minecraft as Web 2.0: amateur creativity and digital games. *From the Selected Works of Greg Lastowka*. Retrieved from https://s3.amazonaws.com/academia.edu.documents/34952963/Minecraft_Web.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1525702310&Signature=X5o0Bf%2BJjfpLw1pKJ2YpWjqAE38%3D&response-content-disposition=inline%3Bfilename%3DMinecraft_as_Web_2.0.pdf

Lazzaro, N. (2004). Why we play games: Four keys to more emotion without story. Retrieved from http://www.xeodesign.com/whyweplaygames/xeodesign_whyweplaygames.pdf

Leach, J. (2001). A Hundred Possibilities: Creativity, Community and ICT. In A. Craft, B. Jeffrey, & M. Leibling (Eds.), *Creativity in Education* (p. 175). Retrieved from https://books.google.co.uk/books?hl=en&lr=&id=eJJY8d26ktkC&oi=fnd&pg=PA175&dq=leach+2001+a+hundred+possibilities&ots=6Zh1aauvml&sig=AqSRI4dA2XglMpGk8SvWSSa7pKQ#v=onepage&q&f=false

Leadbeater, C., & Miller, P. (2004). *The pro-am revolution : how enthusiasts are changing our society and economy*. London: Demos.

Lee, J. J., & Hoadley, C. M. (2007). Leveraging Identity to Make Learning Fun: Possible Selves and Experiential Learning in Massively Multiplayer Online Games (MMOGs). *Innovate: Journal of Online Education*, *3*(6), 9. Retrieved from http://www.innovateonline.info/index.php?view=article&id=348

Lee, M.-C., & Tsai, T.-R. (2010). What drives people to continue to play online games? An extension of technology model and theory of planned behavior. *Intl. Journal of Human–Computer Interaction*, *25*(6), 601–620.

Lehdonvirta, V. (2010). Virtual Worlds Don't Exist: Questioning the Dichotomous Approach in MMO Studies. *Game Studies*, *10*(1).

Leng, E. Y., Zah, W., Ali, W., Mahmud, R. B., & Baki, R. (2010). Computer games development experience and appreciative learning approach for creative process enhancement. *Computers & Education*, *55*, 1131–1144. https://doi.org/10.1016/j.compedu.2010.05.011

Levy, F., & Murnane, R. J. (2004). *The new division of labor: How computers are creating the next job market*. Princeton, NJ: Princeton University Press.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, *22*(140), 55. Retrieved from http://psycnet.apa.org/record/1933-01885-001

Lin, W.-L., Hsu, K.-Y., Chen, H.-C., & Wang, J.-W. (2012). The Relations of Gender and Personality Traits on Different Creativities: A Dual-Process Theory Account. *Psychology of Aesthetics, Creativity, and the Arts*, *6*(2), 112–123. https://doi.org/10.1037/a0026241

Linden Labs. (2003). Second Life. *Linden Labs*.

Linden Labs. (2005). *Teen Second Life*. Linden Labs.

Linderoth, J. (2010). Why gamers don't learn more An ecological approach to games as learning environments. *Digra*. Retrieved from http://www.digra.org/wp-content/uploads/digital-library/10343.51199.pdf

Linderoth, J. (2013). Beyond the digital divide: An ecological approach to gameplay. *Transactions of the Digital Games Research Association*, *1*(1).

Lister, M., Kelly, K., Dovey, J., Giddings, S., & Grant, I. (2003). *New Media: A Critical Introduction*. London and New York: Routledge.

Liu, C. H., & Matthews, R. (2005). Vygotsky's philosophy: Constructivism and its criticisms examined. *International Education Journal*, *6*(3), 386–399. https://doi.org/ISSN: 1443-1475

Lopez, S. J., & Snyder, C. R. (2003). *Positive psychological assessment: A handbook of models and measures.* Retrieved from http://dlia.ir/Scientific/e_book/Philosophy_Psychology_Religion/Psychology/BF_176_176.5_Psychological_Tests_Testing_/000344.pdf#page=152

Loveless, A. (2002). Literature Review in Creativity, New Technologies and Learning. *A NESTA Futurelab Research Report*, *4*. Retrieved from https://telearn.archives-ouvertes.fr/hal-

00190439

Lu, A. S. (2013). Video Games and Learning: Teaching and Participatory Culture in the Digital Age. In *Journal of Children and Media* (Vol. 7). https://doi.org/10.1080/17482798.2012.724596

Lucas, B. (2001). Creative teaching, teaching creativity and creative learning. In A. Craft, B. Jeffrey, & M. Leibling (Eds.), *Creativity in Education* (pp. 35–44). London: Continuum.

Lundgren, S., & Björk, S. (2003). Game mechanics: Describing computer-augmented games in terms of interaction. *Proceedings of TIDSE 2003 (Technologies for Interactive Storytelling and Digital Entertainment)*, (October 4), 45–56. https://doi.org/10.1057/jors.1984.31

Lyons, N., & LaBoskey, V. K. (2002). Why narrative inquiry or exemplars for a scholarship of teaching? In N. Lyons & V. K. LaBoskey (Eds.), *Narrative Inquiry in Practice: Advancing The Knowledge of Teaching.* (pp. 11–27). New York: Teachers College Press.

Macalister, J. (2012). Narrative frames and needs analysis. *System*, *40*(1), 120–128. https://doi.org/10.1016/J.SYSTEM.2012.01.010

MacDonald, R., Byrne, C., & Carlton, L. (2006). Creativity and flow in musical composition: an empirical investigation. *Psychology of Music*, *34*(3), 292–306. https://doi.org/10.1177/0305735606064838

Madjar, N., Greenberg, E., & Chen, Z. (2011). Factors for Radical Creativity, Incremental Creativity, and Routine, Noncreative Performance. *Journal of Applied Psychology*, *96*(4), 730–743. https://doi.org/10.1037/a0022416

Mainemelis, C., & Ronson, S. (2006). IDEAS ARE BORN IN FIELDS OF PLAY: TOWARDS A THEORY OF PLAY AND CREATIVITY IN ORGANIZATIONAL SETTINGS. *Research in Organizational Behavior: An Annual Series of Analytical Essays and Critical Reviews*, *27*, 81–131. https://doi.org/10.1016/S0191-3085(06)27003-5

Malone, T. W. (1981). Toward a Theory of Intrinsically Instruction* Motivating. *COGNITIVE SCIENCE*, *4*, 333–369.

Maslow, A. (1968). *Toward a psychology of being*. Princeton, NJ: Van Nostrand, D.

Mateas, M. (2003). A preliminary poetics for interactive drama and games. *Digital Creativity*, *12*(3), 140–152. https://doi.org/10.1076/digc.12.3.140.3224

Maxis, & The Sims Studio. (2000). *The Sims*. Electronic Arts.

Mayer, R. E. (1983). *Thinking, Problem Solving, Cognition*. New York: Freeman.

Mayer, R. E. (1989). Cognitive views of creativity: Creative teaching for creative learning. *Contemporary Educational Psychology*, *14*(3), 203–211. https://doi.org/10.1016/0361-476X(89)90010-6

McCrae, R. R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of Personality and Social Psychology*, *52*(6), 1258. https://doi.org/10.1037/0022-3514.52.6.1258

Media Molecule. (2008). *Little Big Planet*. Sony Computer Entertainment.

Mekler, E. D., Iacovides, I., & Bopp, J. A. (2018). " A Game that Makes You Question ..." Exploring the Role of Reflection for the Player Experience. *CHI PLAY '18 Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play*, 315–327. Melbourne, Australia.

Mercer, N. (2000). *Worlds and Minds: How we use language to think together*. New York:

Routledge.

Mishra, P., Fahnoe, C., & Henriksen, D. (2013). Creativity, Self-Directed Learning and the Architecture of Technology Rich Environments. *TechTrends*, *57*(1). https://doi.org/10.1007/s11528-012-0623-z

Moffat, D. ., Crombie, W., & Shabalina, O. (2017). Some Video Games Can Increase the Player's Creativity. *International Journal of Game-Based Learning (IJGBL)*, *7*(2).

Mojang. (2011). *Minecraft*. Mojang.

Monolith Soft. (2017). *Xenoblade Chronicles 2*. Nintendo.

Monstars Inc. & Resonair. (2018). *Tetris Effect*. Enhance, Inc.

Moran, S., & John-Steiner, V. (2003). Creativity in the Making: Vygotsky's Contemporary Contribution to the Dialectic of Development and Creativity. In *Creativity and Development* (pp. 81–90).

Mumford, M. D., Connelly, M. S., Baughman, W. A., & Marks, M. A. (1994). Creativity and problem solving: Cognition, adaptability, and wisdom. *Roeper Review*, *16*(4), 241–246. https://doi.org/10.1080/02783199409553589

Namco, Atari, Brains, I., & Networks, N. (1980). *Pac-Man*.

Naughty Dog. (2013). *The Last of Us*. Sony Computer Entertainment.

Naughty Dog. (2016). *Uncharted 4: A Theif's End*. Sony Computer Entertainment.

Naughty Dog. (2017). *Uncharted 4: The Lost Legacy*. Sony Computer Entertainment.

Newman, J. (2004). *Videogames*. London: Routledge.

Nintendo. (2001). *Animal Crossing*. Nintendo.

Nintendo. (2017). Legend of Zelda: Breath of the Wild. *Nintendo*.

Norman, D. A. (1973). Memory, knowledge, and the answering of questions. In R. L. Solso (Ed.), *Contemporary issues in cognitive psychology, The Loyola symposium*. Washington, DC: Winston.

Norman, D. A. (1988). *The Psychology of Everyday Things*. New York: Basic Books.

Obsidian. (2010). *Fallout: New Vegas*. Bethesda Softworks,.

Ochse, R. (1990). *Before the gates of excellence: The determinants of creative genius*. Cambridge, MA: Cambridge University Press.

Ogletree, S. M., & Drake, R. (2007). College Students' Video Game Participation and Perceptions: Gender Differences and Implications. *Sex Roles*, *56*(7–8), 537–542. https://doi.org/10.1007/s11199-007-9193-5

Oliver, M., & Carr, D. (2009). Learning in virtual worlds: using Communities of Practice to explain how people learn from play. *British Journal of Education and Technology*, *40*(3), 444–457.

Ortony, A. (1979). Beyond literal similarity. *Psychological Review*, *86*(3), 161–180. https://doi.org/10.1037/0033-295X.86.3.161

Ott, M., & Pozzi, F. (2012). Digital games as creativity enablers for children. *Behaviour and Information Technology*, *31*(10), 1011–1019.

https://doi.org/10.1080/0144929X.2010.526148

Papert, S. (1993). The children's machine. *TECHNOLOGY REVIEW-MANCHESTER NH-*, *96*.

Paradis, M. (1994). Neurolinguistic Aspects of Implicit and Explicit Memory: Implications for Bilingualism and SLA. In N. Ellis (Ed.), *Implicit and Explicit Learning of Languages* (pp. 394–419). London: Academic Press.

Partnership for 21st Century Skills. (2019). *Partnership for 21st Century Learning: A Network of Battelle for Kids*. Retrieved from http://www.battelleforkids.org/networks/p21

Paul, A. C. (2012). *Wordplay and the Discourse of Video Games: Analysing Words, Design, and Play*. New York: Routledge.

Pellegrino, J. W., & Hilton, M. L. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Retrieved from http://www.nap.edu/catalog.php?record_id=13398

Pelletier, C., & Oliver, M. (2006). Learning to play in digital games. *Learning, Media and Technology*, *31*(4), 329–342. Retrieved from papers://e97baf73-a10d-438d-985b-bee59744e11f/Paper/p644

Perrotta, Carlo, Featherstone, Gill, Aston, Helen, Houghton, Emily, Perrotta, C, Featherstone, G, … Houghton, E. (2013). Game-based learning: latest evidence and future directions. *NFER Research Programme: Innovation in Education*. Retrieved from www.nfer.ac.uk

Peterson, M. (2016). The use of massively multiplayer online role-playing games in CALL: an analysis of research. *Computer Assisted Language Learning*, *29*(7), 1181–1194. https://doi.org/10.1080/09588221.2016.1197949

Piaget, J. (1952). *The origins of intelligence in children*. New York: International University Press.

Piaget, J. (1959). *The Language and Thought of the Child*. Chicago: Psychology Press.

Piaget, J. (1976). Piaget's Theory. In *Piaget and His School*. Berlin: Springer.

PlatinumGames. (2017). *NieR: Automata*. Square Enix.

Plucker, Jonathan A., Beghetto, R. A., & Dow, G. T. (2004). Why Isn't Creativity More Important to Educational Psychologists? Potentials, Pitfalls, and Future Directions in Creativity Research. *Educational Psychologist*, *39*(2), 83–96. https://doi.org/10.1207/s15326985ep3902_1

Plucker, Jonathan A, Beghetto, R. A., & Dow, G. T. (2004). Why Isn't Creativity More Important to Educational Psychologists. *Educational Psychologist*, *39*(March 2014), 83–96. https://doi.org/10.1207/s15326985ep3902

Plucker, J. A., & Runco, M. A. (1998). The death of creativity measurement has been greatly exaggerated: *Current issues, recent advances, and future directions in creativity assessment*. *Roeper Review*, *21*(1), 36–39. https://doi.org/10.1080/02783199809553924

Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. *Qualitative Studies in Education*, *8*(1), 5–23.

Qian, M., & Clark, K. R. (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior*, *63*, 50–58. https://doi.org/10.1016/j.chb.2016.05.023

Resnick, M. (2007). Sowing the Seeds for a more Creative Society. *Learning and Leading with Technology*, *35*(4), 18–22. https://doi.org/10.1145/1518701.2167142

Rhodes, M. (1961). An Analysis of Creativity. *The Phi Delta Kappan*, *42*(7), 305–310. https://doi.org/10.2307/20342603

Richards, R. (1990). Everyday creativity, eminent creativity, and health: "Afterview"; for CRJ Issues on creativity and health. *Creativity Research Journal*, *3*(4), 300–326. https://doi.org/10.1080/10400419009534363

Richards, R. (2007). Everyday Creativity: Our Hidden Potential. *Everyday Creativity and New Views of Human Nature: Psychological, Social, and Spiritual Perspectives.*, 25–54. https://doi.org/10.1037/11595-001

Richards, R. (2010). Process and Way of Life – Four Key Issues. *The Cambridge Handbook of Creativity*, 189–215.

Richards, R., Kinney, D. K., Benet, M., & Merzel, A. P. (1988). Assessing everyday creativity: Characteristics of the Lifetime Creativity Scales and validation with three large samples. *Journal of Personality and Social Psychology*, *54*(3), 476–485. https://doi.org/10.1037//0022-3514.54.3.476

Rieber, L. P. (1996). Seriously Considering Play: Designing Interactive Learning Environments Based on the Blending of Microworlds, Simulations, and Games. *Educational Technology Research and Development*, *44*(2), 43–58. Retrieved from http://lrieber.coe.uga.edu/play.html

Rifkin, J. (2005). When Markets Give Way to Networks … Everything is A Service. In J. Hartley (Ed.), *Creative Industries* (pp. 361–374). Oxford: Blackwell Publishing Ltd.

Rochowicz, J. A. (2010). Bootstrapping Analysis, Inferential Statistics and EXCEL. *Spreadsheets in Education (EJSiE)*, *4*(3). Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.874.8530&rep=rep1&type=pdf

Rockstar. (2008). *Grand Theft Auto IV*. Rockstar Games.

Rockstar Games. (2018). *Red Dead Redemption 2*. Rockstar Games,.

Rogaten, J., & Moneta, G. (2016). Creativity in Higher Education: The Use of Creative Cognition in Studying. In G. B. Moneta & Jetakerina Rogaten (Eds.), *Psychology of Creativity* (pp. 1–20). New Yrk: Nova Publishers.

Rogaten, J., & Moneta, G. (2017). Development and Validation of the Short Use of Creative Cognition Scale in Studying. *Educational Psychology*, *35*(3), 294–314. https://doi.org/10.1080/01443410.2013.857011

Romero, M., Usart, M., & Ott, M. (2015). Can Serious Games Contribute to Developing and Sustaining 21st-Century Skills? *Games and Culture*, *10*(2). https://doi.org/10.1177/1555412014548919

Rose, G. (2007). *An Introduction to the Interpretation of Visual*. Thousand Oaks, CA: Sage Publications.

Runco, M. A. (1991). Metaphors and Creative Thinking. *Creativity Research Journal*, *4*(1), 85–86.

Runco, M. A. (1993). Divergent Thinking, Creativity, and Giftedness. *Gifted Child Quarterly*, *37*(1), 16–22. https://doi.org/10.1177/001698629303700103

Runco, M. A. (2004). Creativity. *Annu. Rev. Psychol*, *55*, 657–687. https://doi.org/10.1146/annurev.psych.55.090902.141502

Russ, S. W., Robins, A. L., & Christiano, B. A. (1999). Pretend play: Longitudinal prediction of

creativity and affect in fantasy in children. *Creativity Research Journal*, *12*(2), 129–139.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, W., Street, E., & Siegel, M. A. (2009). Evaluating Interactive Entertainment using Breakdown: Understanding Embodied Learning in Video Games. *DiGRA*, 1–9. Retrieved from http://www.digra.org/dl/display_html?chid=http://www.digra.org/dl/db/09287.38300.pdf

Saavedra, A. R., & Opfer, V. D. (2012). *Teaching and Learning 21st Century Skills: Lessons from the Learning Sciences*. 35. Retrieved from http://asiasociety.org/files/rand-0512report.pdf

Salen, K., & Zimmerman, E. (2004). *Rules of Play: Game Design Fundamentals*. Cambridge, MA and London: MIT Press.

Salisbury, J. H., & Tomlinson, P. (2016). Reconciling Csikszentmihalyi ' s Broader Flow Theory. *Transactions of the Digital Game Research Association*, *2*(2), 55–77.

Sanchez-Ruiz, M.-J., Santos, M. R., & Jiménez, J. J. (2013). The Role of Metaphorical Thinking in the Creativity of Scientific Discourse. *Creativity Research Journal*, *25*(4), 361–368. https://doi.org/10.1080/10400419.2013.843316

Sapsford, R. (2007). *Survey Research (2nd Edition)*. London: Sage Publications.

Sardone, N. B., & Devlin-Scherer, R. (2010). *Teacher Candidate Responses to Digital Games: 21 st-Century Skills Development* (Vol. 42). Retrieved from www.iste.org.

Sawyer, B., & Smith, P. (2008). Serious games taxonomy. *Presented at the Serious Games Summit during the Game Developers Conference 2008, California*.

Sawyer, R. K. (2006). Group creativity: musical performance and collaboration. *Psychology of Music*, *34*(2), 148–165. https://doi.org/10.1177/0305735606061850

Sawyer, R. K. (2013). Enhancing Creative Incubation. Retrieved September 6, 2018, from Psychology Today UK website: https://www.psychologytoday.com/gb/blog/zig-zag/201304/enhancing-creative-incubation

Schäfer, M. T. (2011). Bastard Culture! *Most*. https://doi.org/10.5117/9789089642561

Schell, J. (2014). *The Art of Game Design: A book of lenses*. CRC Press.

Schmidt, R. (1994). Deconstructing consciousness in search of useful definitions for applied linguistics. *AILA Review*, *11*, 11–26.

Schooler, J. W., & Melcher, J. (1995). The Ineffability of Insight. In R. A. Finke, T. B. Ward, & S. M. Smith (Eds.), *The creative cognition approach* (pp. 97–133). Retrieved from http://psycnet.apa.org/record/1995-97533-005

Schulze, S. (2007). *The usefulness of reflexive photography for qualitative research: a case study in higher education*. Retrieved from http://uir.unisa.ac.za/bitstream/handle/10500/196/ar_schulze_reflexivephotography.pdf accessed 16/01/10?sequence=1

Seddon, F. (2005). Modes of communication during jazz improvisation. *British Journal of Music Education*, *22*(1), 47–61. https://doi.org/10.1017/S0265051704005984

Seddon, F., & Biasutti, M. (2009). Modes of communication between members of a string quartet. *Psychology of Music*, *37*(4), 395–415. https://doi.org/10.1177/1046496408329277

Sheehy, K., Ferguson, R., & Clough, G. (2007). Learning and Teaching in the Panopticon: Ethical and Social Issues in Creating a Virtual Educational Environment. *International Journal of Human and Social Sciences*, *2*(2). Retrieved from http://kmcms.free.fr/virtualworlds/Learning_and_Teaching_in_the_Panopticon.pdf

Shelley, M., Murphy, L., & White, C. J. (2013). Language teacher development in a narrative frame: The transition from classroom to distance and blended settings. *System*, *41*(3), 560–574. https://doi.org/10.1016/J.SYSTEM.2013.06.002

Shepard, R. N. (1978). The mental image. *American Psychologist*, *33*(2), 125–137. https://doi.org/10.1037/0003-066X.33.2.125

Shepard, R. N., & Feng, C. (1972). A chronometric study of mental paper folding. *Cognitive Psychology*, *3*(2), 228–243. https://doi.org/10.1016/0010-0285(72)90005-9

Sherry, J. L., Rosaen, S., Bowman, N. D., & Huh, S. (2006). Cognitive skill predicts video game ability. *Paper Presented at the International Communication Association Annual Convention, Dresden, Germany.*

Shuell, T. (1986). Cognitive Conceptions of Learning. *Review of Educational Research*, *56*(4), 411–436. Retrieved from internal-pdf://shuell-4157868298/shuell.pdf

Shute, V. J., Ventura, M., & Ke, F. (2015). *The power of play: The effects of Portal 2 and Lumosity on cognitive and noncognitive skills*. https://doi.org/10.1016/j.compedu.2014.08.013

Shute, V. J., & Wang, L. (2016). Assessing and Supporting Hard-to-Measure Constructs in Video Games. In A. A. Rupp & J. P. Leighton (Eds.), *The Handbook of Cognition and Assessment: Frameworks, Methodologies, and Applications*. https://doi.org/10.1002/9781118956588.ch22

Sicart, M. (2008). Defining Game Mechanics. *GameStudies: The International Journal of Computer Game Research*, *8*(2). Retrieved from www.miguelsicart.net

Simon, H. A. (1969). *The Science of the Artificial*. Retrieved from http://www.citeulike.org/group/1788/article/975529

Simonton, D. K. (2000). Creativity Cognitive, Personal, Developmental, and Social Aspects. *American Psychologist*, *55*(1), 151–158. https://doi.org/10.1037//0003

Slovak, P., Frauenberger, C., & Fitzpatrick, G. (2017). Reflective Practicum: A Framework of Sensitising Concepts to Design for Transformative Reflection. *CHI 2017 Mindfulness and Reflection, May 6-11*, 2696–2707. https://doi.org/10.1145/3025453.3025516

Smith, P. L., & Ragan, T. J. (2005). *Instructional design third edition*. Wiley & Sons, Inc.

Smithsonian Institute. (2012). The art of video games. *Retrieved from: Http://Www. Americanart.Si.Edu/Exhibitions/Archive/2012/Games/Featuredgames/*.

Songer, R. W., & Miyata, K. (2014). A Playful Affordances Model for Gameful Learning. *TEEM '14, October 01 - 03 2014, Salamanca, Spain*. https://doi.org/10.1145/2669711.2669901

Sony Entertainment. (2008). *LittleBigPlanet*.

Sorensen, J. L. (2007). *Creativity , Learning & Flow*.

Sotamaa, O. (2007). Let me take you to the movies: Productive players, commodification and transformative play. *Convergence*, *13*(4), 383–401. https://doi.org/10.1177/1354856507081961

Sotamaa, O. (2010). Play, Create, Share? Console Gaming, Player Production and Agency. *The Fibreculture Journal*, *16*. Retrieved from http://sixteen.fibreculturejournal.org/play-create-share-console-gaming-player-production-and-agency/

Sourmelis, T., Ioannou, A., & Zaphiris, P. (2017). Massively Multiplayer Online Role Playing Games (MMORPGs) and the 21st century skills: A comprehensive research review from 2010 to 2016. *Computers in Human Behavior*, *67*, 41–48. https://doi.org/10.1016/j.chb.2016.10.020

Squad. (2015). *Kerbal Space Program*. Squad.

Square Enix. (2010). *Final Fantasy XIV*. Square Enix,.

Square Enix. (2018). *Final Fantasy XV*. Square Enix.

Squaresoft. (1997). *Final Fantasy VII*. Edios Interactive and Sony Computer Entertainment.

Squaresoft. (2001). *Final Fantasy X*. Squaresoft.

Stebbins, R. A. (2015). Play and Creativity. In *Leisure and Positive Psychology: Linking Activities with Positiveness* (pp. 133–143). https://doi.org/10.1057/9781137569943.0012

Steinkuehler, C., Alagoz, E., King, E., & Martin, C. (2012). A Cross Case Analysis of Two Out-of-School Programs Based on Virtual Worlds. *International Journal of Gaming and Computer-Mediated Simulations*, *4*(1), 25–54. https://doi.org/10.4018/jgcms.2012010102

Sternberg, R. J. (1988). *The nature of creativity: Contemporary psychological perspectives* (R. J. Sternberg, Ed.). Cambridge, MA: Cambridge University Press.

Sternberg, R. J. (2001). What Is the Common Thread of Creativity? Its Dialectical Relation to Intelligence and Wisdom. *American Psychologist*, *56*(4), 361–362. Retrieved from https://pdfs.semanticscholar.org/9897/9fac7c4e3703fbc99e5c0608a1376f1ab935.pdf

Sternberg, R. J., & Lubart, T. I. (1996). Investing in Creativity. *American Psychologist*, *51*(7), 677–688. https://doi.org/10.1037/0003-066X.51.7.677

Stevens, G., Burley, J., & Divine, R. (1999). Creativity business discipline= higher profits faster from new product development. *Journal of Product Innovation Management*, *16*(5), 455–468.

Stohs, J. H. (1992). Intrinsic Motivation and Sustained Art Activity Among Male Fine and Applied Artists. *Creativity Research Journal*, *5*(3), 245–252. https://doi.org/10.1080/10400419209534438

Swain, J. (2018). A Hybrid Approach to Thematic Analysis in Qualitative Research: Using a Practical Example. *A Hybrid Approach to Thematic Analysis in Qualitative Research: Using a Practical Example*. https://doi.org/10.4135/9781526435477

Sweetser, P., & Wyeth, P. (2005). GameFlow: A Model for Evaluating Player Enjoyment in Games. *Comput. Entertain.*, *3*(3), 3–3. https://doi.org/10.1145/1077246.1077253

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.)*. Boston: MA: Allyn & Bacon.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Taylor, T. L. (2002). Living Digitally: Embodiment in Virtual Worlds. In R. Schroeder (Ed.), *The Social Life of Avatars: Presence and Interaction in Shared Virtual Environments* (pp. 40–62). Retrieved from http://rhetoricandwriting.com/cyborg/wp-content/uploads/2014/02/Taylor-Living-Digitally-Embodiment-in-Virtual-Worlds.pdf

Tencent Games. (2018). *Ring of Elysium*. Tencent Games,.

Terrenghi, L., Fritsche, T., & Butz, A. (2006). The EnLighTable: Design of Affordances to Support Collaborative Creativity. *Smart Graphics, 6th International Symposium, Vancouver, Canada July 2006*, 206–217.

Thompson, A. L., & Klatzky, R. L. (1978). Studies of visual synthesis: Integration of fragments into forms. *Journal of Experimental Psychology: Human Perception and Performance*, *4*(2), 244–263. https://doi.org/10.1037/0096-1523.4.2.244

Thorne, S. L., Black, R. W., & Sykes, J. M. (2009). Second Language Use, Socialization, and Learning in Internet Interest Communities and Online Gaming. *The Modern Language Journal*, *93*, 802–821. https://doi.org/10.1111/j.1540-4781.2009.00974.x

Torrente, J., Moreno-Ger, P., Mart??nez-Ortiz, I., & Fernandez-Manjon, B. (2009). Integration and deployment of educational games in e-learning environments: The learning object model meets educational gaming (Tampere University; Vol. 12). https://doi.org/10.1108/10748120410540463

Treffinger, D. J. (1995). Creative problem solving: Overview and educational implications. *Educational Psychology Review*, *7*, 301–312. Retrieved from http://www.springerlink.com/index/7U72KN87Q14U24W5.pdf

Treffinger, D. J., & Isaksen, S. G. (2005). Creative Problem Solving: The history, development and implications for gifted education and talent development. *Gifted Child Quarterly*, *49*(4). Retrieved from http://www.cpsb.com/research/articles/creative-problem-solving/Creative-Problem-Solving-Gifted-Education.pdf

Treffinger, D. J., Selby, E. C., & Isaksen, S. G. (2007). Understanding individual problem-solving style: A key to learning and applying creative problem solving. *Learning and Individual Differences*. https://doi.org/10.1016/j.lindif.2007.11.007

Trepte, S., Reinecke, L., & Behr, K.-M. (2011). Playing Myself or Playing to Win? In *Discoveries in Gaming and Computer-Mediated Simulations* (pp. 329–352). https://doi.org/10.4018/978-1-60960-565-0.ch019

Treyarch. (2018). *Call of Duty: Black Ops 4*. Activision.

Trilling, B., & Hood, P. (2001). Learning, technology and education reform in the Knowledge Age or "We're wired, webbed and windowed, now what?" In C. F. Paechter, R. Edwards, R. Harrison, & P. Twining (Eds.), *Learning, Space and Identity* (pp. 7–30). London: Sage Publications.

Ukie. (2018). UK Video Games Fact Sheet. In *The Association for UK Interactice Entertainment*. https://doi.org/10.1192/bjp.112.483.211-a

Ültanır, E. (2012). AN EPISTEMOLOGICAL GLANCE AT THE CONSTRUCTIVIST APPROACH: CONSTRUCTIVIST LEARNING IN DEWEY, PIAGET, AND MONTESSORI. *International Journal of Instruction July*, *5*(2), 1694–609. Retrieved from http://files.eric.ed.gov/fulltext/ED533786.pdf

Upper One Games. (2014). Never Alone. *Upper One Games*.

Valve. (2007). *Portal*. Valvle Cooperation.

Valve. (2011). *Portal 2*. Valve Cooperation.

Valve, & Turtle Rock Studios. (2000). *Counter-Strike*. Valve, Nexon, Sierra Entertainment.

Van Eck, R. (2006). Digital game based learning: It's not just the digital native who are restless. *Educause Review*, *41*, 16–30.

Vanlehn, K. (1988). *Problem Solving and Cognitive Skill Aquisition*. Retrieved from https://apps.dtic.mil/dtic/tr/fulltext/u2/a218905.pdf

VanLehn, K., Siler, S., Murray, C., Yamauchi, T., & Baggett, W. B. (2003). Why Do Only Some Events Cause Learning During Human Tutoring? *Cognition and Instruction*, *21*(3), 209–249. https://doi.org/10.1207/S1532690XCI2103_01

Ventura, M., Shute, V., & Kim, Y. J. (2012). Video gameplay, personality and academic performance. *Computers & Education*, *58*, 1260–1266. https://doi.org/10.1016/j.compedu.2011.11.022

von Glasersfeld, E. (1995). A constructivist approach to teaching. In L. P. Steffe & J. Gale (Eds.), *Constructivism and Education*. New Jersey: Lawrence Erblaum.

Voulgari, I., Komis, V., & Sampson, D. G. (2014). Learning outcomes and processes in massively multiplayer online games: Exploring the perceptions of players. *Educational Technology Research and Development*, *62*(2), 245–270. https://doi.org/10.1007/s11423-013-9312-7

Vygotsky, L. S. (1962). Thought and Language. *October*, *28*(4), 153. https://doi.org/10.2307/1249570

Vygotsky, L. S. (2004). Imagination and Creativity in Childhood. *Journal of Russian and East European Psychology*, *42*(1), 7–97. Retrieved from http://lchc.ucsd.edu/mca/Mail/xmcamail.2008_03.dir/att-0189/Vygotsky__Imag___Creat_in_Childhood.pdf

Walker, C. J. (2010). Experiencing flow: Is doing it together better than doing it alone? *The Journal of Positive Psychology*, *5*(1), 3–11. https://doi.org/10.1080/17439760903271116

Wallace, L. (2015). Reflexive photography, attitudes, behavior, and CALL: ITAs improving spoken English intelligibility. *Calico Journal*, *32*(3), 449–479. https://doi.org/10.1558/cj.v32i3.26384

Ward, T. B. (2007). Creative cognition as a window on creativity. *Methods*, *42*, 28–37. https://doi.org/10.1016/j.ymeth.2006.12.002

Ward, T. B. (2015). Content, Collaboration, and Creativity in Virtual Worlds. In G. P. Green & J. C. Kaufman (Eds.), *Video Games and Creativity* (pp. 119–136). https://doi.org/10.1016/B978-0-12-801462-2.00006-0

Watson, E. (2007). Who or What Creates? A Conceptual Framework for Social Creativity. *Human Resource Development Review*, *6*(419). https://doi.org/10.1177/1534484307308255

Weber, R., Behr, K. M., & DeMartino, C. (2014). Measuring Interactivity in Video Games. *Communication Methods and Measures*, *8*(2), 79–115. https://doi.org/10.1080/19312458.2013.873778

Weick, K. E. (1979). The social psychology of organizing. *Administrative Science Quarterly*, *2*, 294. https://doi.org/10.2307/2392295

Weisberg, R. W. (1986). Creativity: genius and other myths. In *Series of books in psychology*. https://doi.org/10.1002/acp.2350010112

Whitby, M. A., Deterding, S., & Iacovides, I. (2019). "One of the baddies all along": Moments that Challenge a Player's Perspective. *CHI PLAY 2019, 22-25 Oct 2019*, 339–350. https://doi.org/10.1145/3311350.3347192

Withagen, R., & Caljouw, S. R. (2017). Aldo van Eyck's playgrounds: Aesthetics, affordances, and creativity. *Frontiers in Psychology*, *8*(JUL), 1–9. https://doi.org/10.3389/fpsyg.2017.01130

Withagen, R., & van der Kamp, J. (2018). An ecological approach to creativity in making. *New Ideas in Psychology*, *49*, 1–6. https://doi.org/10.1016/j.newideapsych.2017.11.002

Witt, L. A., & Beorkrem, M. N. (1989). Climate for creative productivity as a predictor of research usefulness and organizational effectiveness in an r&d organization. *Creativity Research Journal*, *2*(1–2), 30–40. https://doi.org/10.1080/10400418909534298

Wray, D., & Lewis, M. (1997). *Extending Literacy: Children Reading and Writing Non-fiction*. London: Routledge.

Wright, T., Boria, E., & Breidenbach, P. (2002). Creative Player Actions in FPS Online Video Games Playing Counter-Strike. *Game Studies*, *2*. Retrieved from https://www.researchgate.net/profile/Talmadge_Wright/publication/220200729_Creative_Player_Actions_in_FPS_Online_Video_Games_-_Playing_Counter-Strike/links/0deec53566263ae497000000.pdf

Wright, W. (2006). Dream machines. *Wired Magazine*, *14*(4), 110–112.

Yager Development. (2012). *Spec Ops: The Line*. 2K Games.

Yeh, Y. chu, Lai, S. C., & Lin, C. W. (2016). The dynamic influence of emotions on game-based creativity: An integrated analysis of emotional valence, activation strength, and regulation focus. *Computers in Human Behavior*, *55*, 817–825. https://doi.org/10.1016/j.chb.2015.10.037

Young, M. F., Slota, S., Cutter, A. B., Jalette, G., Mullin, G., Lai, B., … Yukhymenko, M. (2012). Our Princess Is in Another Castle: A Review of Trends in Serious Gaming for Education. *Review of Educational Research*, *82*(1), 61–89. https://doi.org/10.3102/0034654312436980

Young, R. M., & Cardona-Rivera, R. E. (2011). Approaching a Player Model of Game Story Comprehension Through Affordance in Interactive Narrative. *Proceedings of the 4th Workshop on Intelligent Narrative Technologies*, 123–130. Retrieved from www.aaai.org

Zhang, P. (2008). Motivational affordances: Reasons for ICT design and use. *Communications of the ACM*, *51*(11), 145–147. https://doi.org/10.1145/1400214.1400244

[This page is intentionally left blank]

# Appendices

## Appendix 1: Creativity in Gaming Survey

# Creativity in Digital Games Survey

## Page 1: Consent Form

Hello!

Thank you for volunteering to take part in this study.

This research study is about how creativity within, around and inspired by digital games may contribute to learning. This also involves what creative aspects, skills and developments gained from playing digital games may be transferrable to other areas of life, such as the workplace or in other creative hobbies.

The survey involves asking you about your gaming habits (e.g. what types of games you play, for how long, etc) and also about your attitudes relating to creativity in digital games. The attitude statements are rated on a 5-point scale from strongly disagree to strongly agree. There are also some open-ended questions for you to give additional information, however, these are optional.

The survey should take around 30 minutes to complete.

More information can be found in the information leaflet for the study which we recommend you familiarise yourself with before taking the survey: https://static.onlinesurveys.ac.uk/media/account/68/survey/382712/question/Information_Leaflet_Phase_2_c71w893.pdf

This research project strictly follows the Code of Ethics and Conduct of the British Psychological Society (BPS).

Before we continue you will need to give fully informed consent.

In order to provide informed consent please read over the statements below carefully before checking them.

If you have any questions regarding the statements please get in touch with the principal researcher. Alternatively, you may contact the principal supervisor or any other member of the research team.

**Research Team**

Principal Researcher: Johanna Hall (johanna.hall@open.ac.uk)

Principal Supervisor: Dr. Ursula Stickler (ursula.stickler@open.ac.uk)

Dr. Christothea Herodotou (christothea.herodotou@open.ac.uk)

Dr. Jo Iacovides (jo.iacovides@york.ac.uk)

1. I confirm that I am over the age of 18. ✱ *Required*

☐ Confirm

2. I confirm that I have read and understand the information for the above study and have had the opportunity to ask questions. ✱ *Required*

☐ Confirm

3. I understand that my participation is voluntary and that I am free to withdraw at any time up until the designated date specified, without giving reason. ✱ *Required*

☐ Confirm

4. I agree to the use of anonymised quotes and/or statistical data in publications. ✱ *Required*

☐ Confirm

5. I agree to take part in the above study. ✱ *Required*

☐ Confirm

## Page 2: My Gaming Habits

Thank you for completing the consent form. We now just need to collect some initial data about yourself and your gaming habits.

6. What is your age?

7. Gender:

- Male
- Female
- Nonbinary
- Prefer not to say

8. Nationality:

9. Education level:

9.a. If you selected Other, please specify:

10. Occupation:

11. Do you regularly engage in any creative pursuits? Please select all that apply.

- [ ] Playing a musical instrument/composition
- [ ] Creative writing
- [ ] Art/crafts
- [ ] Multimedia creation (video editing, game design, web design, software development, graphic design, etc)
- [ ] Cooking
- [ ] Gardening
- [ ] Tabletop games such as D&D
- [ ] Live Action Role Play
- [ ] Amateur dramatics
- [ ] Other

11.a. If you selected Other, please specify:

11.b. Are any of these game-related (e.g. based on digital games)? If so please specify.

12. In terms of digital games, what type of gamer do you feel most accurately represents you?

- ○ Hardcore Gamer
- ○ Moderate Gamer
- ○ Casual Gamer
- ○ Total Novice
- ○ None of the above
- ○ Other

12.a. If you selected Other, please specify:

13. What platforms do you use for gaming?

- [ ] PC/Mac/Linux
- [ ] Console
- [ ] Handheld Consoles
- [ ] Mobile
- [ ] Other

13.a. If you selected Other, please specify:

14. On average, how many hours do you play online digital games per week?

Please enter a number.

15. On average, how many hours do you play offline digital games a week?

Please enter a number.

16. How many hours does a typical gaming session last?

Please enter a number.

17. What types of online digital games do you play?

- [ ] Role Playing (MMORPG)
- [ ] Real Time Strategy (MMORTS)
- [ ] Battle Arena (MMOBA)
- [ ] First Person Shooter (MMOFPS)
- [ ] Social Games (MMOSocial)
- [ ] Racing Games (MMOR)
- [ ] Sports Games (MMOSports)
- [ ] Management Games (MMOMG)
- [ ] Bulletin Board Games (MMOBBG)
- [ ] Other
- [ ] I don't play online digital games

17.a. If you selected Other, please specify:

18. What types of offline digital games do you play?

- [ ] First Person Shooter
- [ ] Role Playing
- [ ] Racing
- [ ] Action/Adventure
- [ ] Simulation
- [ ] Platform
- [ ] Puzzle
- [ ] Strategy/Tactics
- [ ] Dance/Rhythm
- [ ] Survival Horror
- [ ] Sport

- [ ] Fighting
- [ ] Visual Novel
- [ ] Other
- [ ] I don't play offline digital games

18.a. If you selected Other, please specify:

19. Currently (e.g. in the past month), what game/games have you played the most? Please list all that apply.

## Page 3: What Creativity Means To Me

The following sets of statements apply to your experiences of digital games and your attitdues towards them in terms of creativity. These include how conceptualise creativity in games, and what elements of games you feel may promote creative behaviour.

There are also some open-ended questions for you to provide examples and additional information, while these are optional, please complete them if you can.

*20.* Please state the extent to which you agree with the following statements 1= disagree strongly, 2= disagree somewhat, 3= neither disagree/agree, 4= agree somewhat, 5= agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Games offer opportunities for coming up with creative solutions | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games are an outlet for my creativity | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games should be viewed as art forms like novels and films | ☐ | ☐ | ☐ | ☐ | ☐ |
| Being creative when I play games is not that important to me | ☐ | ☐ | ☐ | ☐ | ☐ |
| The creativity involved in games is mainly from the developer's side and not something the player can engage with | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games are like performances, similar to plays and films | ☐ | ☐ | ☐ | ☐ | ☐ |
| You can be creative when you play games | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games which allow the freedom to build and make things are the most creative | ☐ | ☐ | ☐ | ☐ | ☐ |

### Possibilities for Play

21. Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| I enjoy games which allow me to try out different play styles | ☐ | ☐ | ☐ | ☐ | ☐ |
| I do not enjoy games where I can diverge from the main story and explore side quests | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy games which allow me to find different ways of doing things | ☐ | ☐ | ☐ | ☐ | ☐ |
| Exploring the environment in a game is important to me | ☐ | ☐ | ☐ | ☐ | ☐ |
| I prefer games which have a pre-defined path | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games which allow more freedom for the player are more likely to involve creativity | ☐ | ☐ | ☐ | ☐ | ☐ |
| I prefer games that let me choose the personality of my character through dialogue choices | ☐ | ☐ | ☐ | ☐ | ☐ |
| I dislike games which have multiple endings and outcomes | ☐ | ☐ | ☐ | ☐ | ☐ |
| I actively seek games which are different than those I have played before | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games which allow opportunities to interact with the environment help me be more creative in how I play | ☐ | ☐ | ☐ | ☐ | ☐ |
| I prefer to always play the same types of games | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | |
|---|---|---|---|---|---|
| I dislike games which have many different types of actions, items and controls | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy games where I have the freedom to change the look of my avatar | ☐ | ☐ | ☐ | ☐ | ☐ |

## Page 4: When I Am Creative In Games

22. Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| I enjoy coming up with new strategies when I play games | ☐ | ☐ | ☐ | ☐ | ☐ |
| I plan how to approach problems and challenges in a game before doing them | ☐ | ☐ | ☐ | ☐ | ☐ |
| I consult guides/videos before tackling difficult challenges | ☐ | ☐ | ☐ | ☐ | ☐ |
| I mainly overcome challenges using a trial and error approach | ☐ | ☐ | ☐ | ☐ | ☐ |
| I highly value the sense of achievement I get when overcoming difficult challenges in games | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy experimenting with what I can do using different game variables | ☐ | ☐ | ☐ | ☐ | ☐ |
| I do not enjoy coming across something new in a game | ☐ | ☐ | ☐ | ☐ | ☐ |

### Glitches and Emergent Play

Glitches: software errors which are not supposed to be in the game on release. These can cause problems in the game such as preventing progression, however, can also be used by players to exploit aspects of the game. This can include bypassing sections of the game, performing actions which otherwise are not allowed in the game, or becoming very powerful early on.

23. Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| I like to test the boundaries of what the game allows | ☐ | ☐ | ☐ | ☐ | ☐ |
| I actively seek out glitches | ☐ | ☐ | ☐ | ☐ | ☐ |
| I try and find shortcuts in games | ☐ | ☐ | ☐ | ☐ | ☐ |
| I use glitches to enable me to progress in the game | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy using the game mechanics in new, unintended ways | ☐ | ☐ | ☐ | ☐ | ☐ |
| I prefer to play games without using modifications | ☐ | ☐ | ☐ | ☐ | ☐ |
| I use glitches mainly as a source of fun/laughs | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy creating additional challenges for myself in games such as upping the difficulty | ☐ | ☐ | ☐ | ☐ | ☐ |
| Glitches detract from the way a game is meant to be played | ☐ | ☐ | ☐ | ☐ | ☐ |
| I try and find ways to adapt and bend the rules of the game | ☐ | ☐ | ☐ | ☐ | ☐ |

## How Games Have Affected Me

*24.* Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Playing games has made me come to view things in everyday life differently | ☐ | ☐ | ☐ | ☐ | ☐ |
| I play games where I can relate to the main characters | ☐ | ☐ | ☐ | ☐ | ☐ |
| Playing games has made me realise things about myself | ☐ | ☐ | ☐ | ☐ | ☐ |
| I do not enjoy games which tackle difficult and emotionally challenging themes | ☐ | ☐ | ☐ | ☐ | ☐ |
| The narrative of a game is important to me | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy games which give me a new perspective of other cultures and societies | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games have made me view religious and moral issues differently | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have come to question the concept of humanity through playing games | ☐ | ☐ | ☐ | ☐ | ☐ |
| Playing games have changed the way I view other people | ☐ | ☐ | ☐ | ☐ | ☐ |
| I do not enjoy games which make me question things | ☐ | ☐ | ☐ | ☐ | ☐ |
| I do not enjoy games which break the mould | ☐ | ☐ | ☐ | ☐ | ☐ |
| Playing games have introduced me to new perspectives of what is possible in game development | ☐ | ☐ | ☐ | ☐ | ☐ |

## Page 5: What I Learn From Being Creative In Games

The following sets of statements apply to what you feel you may have learnt from being creative in games. This also includes other areas of your life where you may have used skills and ideas gained from being creative in games.

There are also some open-ended questions for you to provide examples and additional information, while these are optional, please complete them if you can.

*25.* Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Being creative in games has helped increase my social and communication skills | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have developed IT/technical skills through being creative in games | ☐ | ☐ | ☐ | ☐ | ☐ |
| As a result of creativity in games, my hand-eye coordination has increased | ☐ | ☐ | ☐ | ☐ | ☐ |
| Being creative in games has increased my musical knowledge | ☐ | ☐ | ☐ | ☐ | ☐ |
| Playing games dulls the mind | ☐ | ☐ | ☐ | ☐ | ☐ |
| Being creative in games has developed my problem-solving and thinking skills | ☐ | ☐ | ☐ | ☐ | ☐ |
| Being creative in games has given me more confidence | ☐ | ☐ | ☐ | ☐ | ☐ |
| As a results of creativity in games my reaction speed has increased | ☐ | ☐ | ☐ | ☐ | ☐ |

14 / 23

| | | | | | |
|---|---|---|---|---|---|
| I do not value what I learn from being creative in games | ☐ | ☐ | ☐ | ☐ | ☐ |

*25.a.* Please select what areas, if any, the skills and knowledge you have learnt from being creative in games best fall into (select all that apply).

- ☐ Musical/Compositional Knowledge
- ☐ Art/Crafts
- ☐ Problem-Solving
- ☐ Critical Thinking
- ☐ Reasoning
- ☐ Language/Literacy
- ☐ Communication
- ☐ Confidence
- ☐ Teamworking
- ☐ Leadership
- ☐ Technical
- ☐ Motor skills
- ☐ Reaction Speed
- ☐ History/Culture
- ☐ Empathy
- ☐ Other

*25.a.i.* If you selected Other, please specify:

## Transferability of Game-Based Creativity

*26.* Please state the extent to which you agree with the following statements 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree/agree, 4 = agree somewhat, 5 = agree strongly

Please don't select more than 1 answer(s) per row.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Games have given me ideas which I have then used or created in other areas of life | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games have inspired me to write my own music or play songs from games | ☐ | ☐ | ☐ | ☐ | ☐ |
| The more creative I am in games, the more creative I am in everyday life | ☐ | ☐ | ☐ | ☐ | ☐ |
| Being creative in games gives me a new perspective on problems and challenges in my everyday life | ☐ | ☐ | ☐ | ☐ | ☐ |
| The more creative I am in everyday life, the more creative I am in games | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games have influenced my attitudes or behaviours in other areas of life | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have used what I have learnt from games in my job/workplace | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games have inspired me to go and study certain subjects | ☐ | ☐ | ☐ | ☐ | ☐ |
| Games have given me ideas to try out in other games that I play | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have never used the skills and knowledge developed in games elsewhere in my life | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoy writing fiction based on the games I play | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have incorporated ideas from games into my own art/craft projects | ☐ | ☐ | ☐ | ☐ | ☐ |

## Page 6: Feedback

Thank you for completing the Creativity and Learning survey. Before you go, we would very much appreciate your feedback on the survey.

27. Did you find any questions difficult or ambiguous? Please specify.

28. Do you have any improvements/recommendations for the survey?

29. Is there anything else you would like to add?

Please provide your email address if you would like to recieve any of the following:

30. Email Address:

17 / 23

30.a. Notifications regarding other research opportunities

- Yes
- No

30.b. A summary of the research findings

- Yes
- No

30.c. Any resulting publications and final thesis

- Yes
- No

## Page 7: Completion

Thank you for completing the Creativity and Learning in Digital Games Survey. If you have any questions please do not hesitate to contact the principal researcher or any member of the research team.

**For SurveyCircle users (www.surveycircle.com): The Survey Code is: SX3S-RX41-7DFA-337P**

**Research Team**

Principal Researcher: Johanna Hall (johanna.hall@open.ac.uk)

Principal Supervisor: Dr. Ursula Stickler (ursula.stickler@open.ac.uk)

Dr. Christothea Herodotou (christothea.herodotou@open.ac.uk)

Dr. Jo Iacovides (jo.iacovides@york.ac.uk)

---

## Key for selection options

**6 - What is your age?**

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

**8 - Nationality:**

- Afghan
- Albanian
- Algerian
- American
- Andorran
- Angolan
- Antiguans
- Argentinean
- Armenian
- Australian
- Austrian
- Azerbaijani
- Bahamian
- Bahraini
- Bangladeshi
- Barbadian
- Barbudans
- Batswana
- Belarusian

Belgian
Belizean
Beninese
Bhutanese
Bolivian
Bosnian
Brazilian
British
Bruneian
Bulgarian
Burkinabe
Burmese
Burundian
Cambodian
Cameroonian
Canadian
Cape Verdean
Central African
Chadian
Chilean
Chinese
Colombian
Comoran
Congolese
Costa Rican
Croatian
Cuban
Cypriot
Czech
Danish
Djibouti
Dominican
Dutch
East Timorese
Ecuadorean
Egyptian
Emirian
Equatorial Guinean
Eritrean
Estonian
Ethiopian
Fijian
Filipino
Finnish
French
Gabonese
Gambian
Georgian

German
Ghanaian
Greek
Grenadian
Guatemalan
Guinea-Bissauan
Guinean
Guyanese
Haitian
Herzegovinian
Honduran
Hungarian
I-Kiribati
Icelander
Indian
Indonesian
Iranian
Iraqi
Irish
Israeli
Italian
Ivorian
Jamaican
Japanese
Jordanian
Kazakhstani
Kenyan
Kittian and Nevisian
Kuwaiti
Kyrgyz
Laotian
Latvian
Lebanese
Liberian
Libyan
Liechtensteiner
Lithuanian
Luxembourger
Macedonian
Malagasy
Malawian
Malaysian
Maldivan
Malian
Maltese
Marshallese
Mauritanian
Mauritian

Mexican
Micronesian
Moldovan
Monacan
Mongolian
Moroccan
Mosotho
Motswana
Mozambican
Namibian
Nauruan
Nepalese
New Zealander
Nicaraguan
Nigerian
Nigerien
North Korean
Northern Irish
Norwegian
Omani
Pakistani
Palauan
Panamanian
Papua New Guinean
Paraguayan
Peruvian
Polish
Portuguese
Qatari
Romanian
Russian
Rwandan
Saint Lucian
Salvadoran
Samoan
San Marinese
Sao Tomean
Saudi
Scottish
Senegalese
Serbian
Seychellois
Sierra Leonean
Singaporean
Slovakian
Slovenian
Solomon Islander
Somali

South African
South Korean
Spanish
Sri Lankan
Sudanese
Surinamer
Swazi
Swedish
Swiss
Syrian
Taiwanese
Tajik
Tanzanian
Thai
29 / 31
Togolese
Tongan
Trinidadian or Tobagonian
Tunisian
Turkish
Tuvaluan
Ugandan
Ukrainian
Uruguayan
Uzbekistani
Venezuelan
Vietnamese
Welsh
Yemenite
Zambian
Zimbabwean
Prefer not to Say

**9 - Education level:**

High School
College
Undergraduate Degree
Postgraduate Degree
Doctorate
Other

---

## Phase 3: Reflexive Photography Task

**Image** (please copy & paste below)

**Caption:**

**Any additional comments:**